Draft Environmental Impact Statement

ORO CRUZ OPERATION

OF THE

AMERICAN GIRL MINING PROJECT

Prepared By:

Bureau of Land Management
El Centro Resource Area
El Centro, California

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

P.M. De Dycker & Associates, Inc.
Lakewood, Colorado

April 1994

United States Department of the Interior

TAKE PRIDE IN AMERICA

BUREAU OF LAND MANAGEMENT
El Centro Resource Area
1661 South 4th Street
El Centro, California 92243-4561

IN REPLY REFER TO:
3809
ORO CRUZ POO
(CA-067.20)

April 29, 1994

Dear Reader:

We are pleased to provide you with this Draft Environmental Impact Statement (EIS) for the proposed Oro Cruz Operation of the American Girl Canyon Project for your review and comment. The Oro Cruz Operation is a proposed surface and underground gold mining project on 191 acres of public land in Imperial County, California. The purpose of this Draft EIS is to identify and describe the environmental consequences that would result from the proposed mining operation.

This Draft EIS has been prepared to meet the requirements of the National Environmental Policy Act and the Council on Environmental Quality's implementing regulations (40 CFR 1500). The document has been prepared by P. M. DeDycker and Associates, Inc., an independent environmental consultant, under the direction of the Bureau of Land Management.

A 60-day public review period has been established for this document. Written comments concerning the adequacy of this document will be considered in preparation of the Final EIS. The public comment period will end on June 28, 1994. Written comments should be addressed to:

Bureau of Land Management
El Centro Resource Area
1661 South Fourth Street
El Centro, CA 92243

Attention: Thomas Zale

No public hearings are presently planned. However, should public demand warrant, a hearing would be held by the Bureau of Land Management.

Sincerely,

Thomas F. Zale

G. Ben Koski
Area Manager

Alternatives to the proposed action include:

- No Action
- Complete Backfilling of Waste Rock
- Cyanide Solution Application Via Drip Emitters
- Floating Cover on Ponds Containing Cyanide Solution

Additional changes in mining and processing operations and changes in the location of some project facilities and components were considered, but eliminated from further analysis in the Draft EIS on the basis of technical and economic feasibility, and/or environmental consequences.

The environmental consequences of the proposed action and alternatives are addressed in the Draft EIS in terms of the following elements of the human environment:

- Climate and Air Quality
- Geology
- Hydrology
- Soils
- Vegetation
- Wildlife
- Land Use
- Recreation
- Visual Resources
- Sound
- Cultural Resources
- Transportation
- Socioeconomics

Issues identified and addressed through the scoping process and evaluated in the Draft EIS include wildlife, cultural resources, visual resources, recreational use and public safety, cyanide management, and reclamation. Impacts to wildlife would remain significant and unavoidable, even after mitigation.

Public Review: This Draft EIS is being distributed for a 60-day public review and comment period. This review and comment period will end on June 28, 1994. Written comments on the Draft EIS should be submitted to the BLM at the above address and should be received no later than June 28, 1994.

No public hearings are presently planned. However, should public demand warrent, a public hearing would be held by the BLM.

This document has been approved for public review.

Henri R Bisson

Henri R. Bisson
District Manager
California Desert District

Cover Sheet

Draft Environmental Impact Statement For The Proposed Oro Cruz Operation Imperial County, California

Lead Agency: U.S. Department of the Interior
Bureau of Land Management
California Desert District
El Centro Resource Area
El Centro, California

Proposed Action: Excavation of two open pits and an underground mine, a waste rock dump and three smaller development dumps, a haul road to existing processing facilities, and a source of aggregate.

Comments or requests for information should be directed to the Bureau of Land Management as follows:

Bureau of Land Management
El Centro Resource Area
1661 South Fourth Street
El Centro, CA 92243
(619) 353-1060
Attention: Thomas Zale

Designation: Draft Environmental Impact Statement (EIS)

Abstract: In accordance with the National Environmental Policy Act, the Bureau of Land Management (BLM) published a Notice of Intent to prepare an EIS for the Proposed Oro Cruz Operation of the American Girl Project on June 5, 1992. A Plan of Operation for the Proposed Oro Cruz Operation of the American Girl Project was first submitted to BLM by American Girl Mining Joint Venture (AGMJV) in March 1992 and was subsequently revised in May 1993. AGMJV is a joint venture of MK Gold Company, a wholly owned subsidiary of Morrison-Knudsen Corporation, and Eastmaque Gold Mining, Ltd., a wholly owned subsidiary of Equinox Resources, Ltd.

The proposed action is a surface and underground mining project on unpatented lode and placer claims on public lands in Imperial County, California. About 2.5 million tons of ore and 8.5 million tons of waste rock would be mined from two open pits, the Cross Pit and the Queen Pit, during an estimated two year period. The Queen Pit would be backfilled upon completion of mining. Underground mining would begin in the Cross Pit and be conducted concurrently with surface mining. One-half million tons of ore and 65,000 tons of waste rock would be produced during a three year period. Ore produced by both surface and underground mining would be transported 2.5 miles by haul trucks to existing mill and heap leach facilities in American Girl Canyon via a proposed haul road. Waste rock would be disposed of in the Queen Pit, and on one large and three smaller waste rock dumps. Aggregate for use in stabilizing underground mine workings would be hauled from a quarry near the existing American Girl Canyon facilities to the Cross Pit along the same haul road. Surface disturbance resulting from the proposed action would total 191 acres.

DRAFT ENVIRONMENTAL IMPACT STATEMENT

ORO CRUZ OPERATION

OF THE

AMERICAN GIRL MINING PROJECT

Prepared By:

Bureau of Land Management
El Centro Resource Area
1661 South Fourth Street
El Centro, California 92243

P.M. De Dycker & Associates, Inc.
12596 West Bayaud Ave. Suite 380
Lakewood, Colorado 80228

April 1994

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SUMMARY

This Draft Environmental Impact Statement (EIS) describes the possible environmental consequences of the proposed Oro Cruz operation of the American Girl Project. This section provides a summary of the EIS. The reader is referred to the full document or the specific chapter in question for a more detailed presentation of each topic. The organization of the main content of this EIS is as follows:

- *Chapter 1 - Introduction*
- *Chapter 2 - Proposed Action, Alternatives and Activities Affecting the Cumulative Environment*
- *Chapter 3 - Existing Environment*
- *Chapter 4 - Consequences of the Proposed Action and Alternatives*
- *Chapter 5 - Cumulative Impacts*
- *Chapter 6 - Other Required Considerations*
- *Chapter 7 - List of Preparers*
- *Chapter 8 - Consultation and Coordination*
- *Chapter 9 - References*
- *Chapter 10 - Glossary*

The proposed Oro Cruz operation would consist of underground and surface gold mining and use of existing gold ore processing facilities in the Cargo Muchacho Mountains in Imperial County, California near the Arizona border (see Figure S-1). The American Girl Project currently consists of two adjacent operating components, the Padre Madre operation and the American Girl Canyon operation. The proposed Oro Cruz operation would be the third operating component of the American Girl Project.

The American Girl Project is a gold mining and processing operation owned by the American Girl Mining Joint Venture (AGMJV). American Girl Mining Joint Venture is a joint venture of MK Gold Company, a wholly owned subsidiary of Morrison-Knudsen Corp. (M-K), and Eastmaque Gold Mining Ltd., a wholly owned subsidiary of Equinox Resources, Ltd. (Equinox). AGMJV submitted a Plan of Operation (POO) to the Bureau of Land Management (BLM) describing the proposed Oro Cruz operation in June, 1992. The POO was supplemented with additional information in February and May, 1993.

THE PROPOSED ACTION

The need for additional ore reserves has led AGMJV to propose the development of the Oro Cruz property, located approximately 2.5 miles north of the existing American Girl Canyon facilities (see Figure S-2). Like Padre Madre and American Girl Canyon, the proposed Oro Cruz operation would be operated and controlled by AGMJV.

The Oro Cruz property consists of unpatented lode and placer claims located entirely on lands administered by the BLM. All claims affected by the operation are controlled by AGMJV through direct ownership or various lease arrangements. The area has a long history of mining and mineral exploration activities that has left the property with considerable surface disturbance. The exploration activities that have been conducted by AGMJV and previous property holders have delineated both surface and underground mining targets. Because of AGMJV's

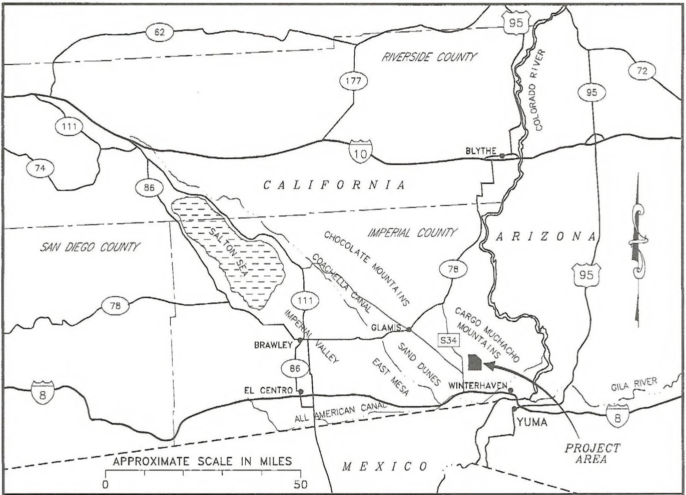


FIGURE S-1

GENERAL SITE LOCATION

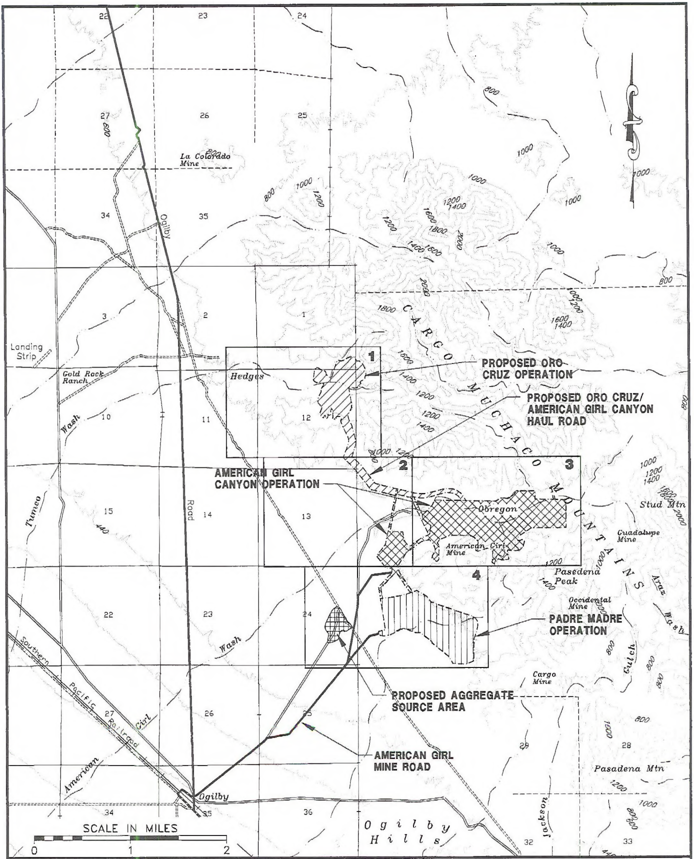


FIGURE S-2

AMERICAN GIRL PROJECT
SITE LAYOUT MAP

ability to develop the proposed Oro Cruz property in conjunction with the American Girl Canyon operation, the Oro Cruz operation would be limited to the mining of surface and underground deposits, haul roads, and waste rock disposal facilities. As proposed by AGMJV, Oro Cruz ore processing by heap leaching and milling would be conducted within the existing and approved American Girl Canyon operational areas.

Initial mining from the Oro Cruz operation is proposed to be conducted via two open pits, the Cross Pit and the Queen Pit. The ore and waste rock would be extracted by using the front-end loaders and trucks in the same manner as Padre Madre and American Girl Canyon open pits. In fact, mining from all operations would be phased so that much of the same equipment currently in use can be employed, with no nominal increase in daily ore production. Once surface mining is completed, the Cross pit is proposed for use as access for underground mining.

Surface mining at Oro Cruz is proposed to begin in Summer 1994 and would continue for three years, with 2.5 million tons of ore and 8 million tons of waste rock being produced (see Figure S-3). As proposed, the underground development would result in 500,000 tons of ore being produced. Underground development would begin in late 1994, with full scale production in 1995. The higher and lower grade ores would be segregated during mining and treated separately for processing. The lower grade ore would be crushed at the existing American Girl Canyon crusher and hauled to the existing leach pad in the American Girl Canyon. Virtually all of the underground ore and approximately 600,000 tons (between 15 to 20 percent) of the surface ore would be hauled to the existing crusher and processed in the conventional cyanide mill at American Girl Canyon. The mill tailings would be agglomerated and placed on the American Girl Canyon heap leach. The proposed Oro Cruz operation concept is illustrated in Figure S-4. Future production from the American Girl Project (including the proposed Oro Cruz operation) is shown in Table S-1. As shown in Table S-2, the proposed Oro Cruz operation would disturb an additional 191 acres, bringing the cumulative projected disturbance for the entire American Girl Project to 809 acres.

PURPOSE AND NEED

Gold is a precious metal for which there is worldwide demand. AGMJV owns or controls unpatented mining claims in the Oro Cruz area which overlie ore that contains gold. The purpose of the proposed action is to extract this ore from two open pits and an underground mine, and process the ore using both milling and heap leaching techniques. The resulting product, dore' bars, would be a salable commodity containing gold and other precious metals. AGMJV has designed the proposed action to satisfy the need to produce this salable commodity in a prudent and profitable manner.

In addition to the proposed mining and processing techniques, the applicant has proposed a number of environmental protection and reclamation initiatives in order to comply with BLM and other public agency laws and regulations. AGMJV has the legal right to mine and process these gold resources according to U.S. mining law unless environmental laws or regulations would be violated, or BLM determines

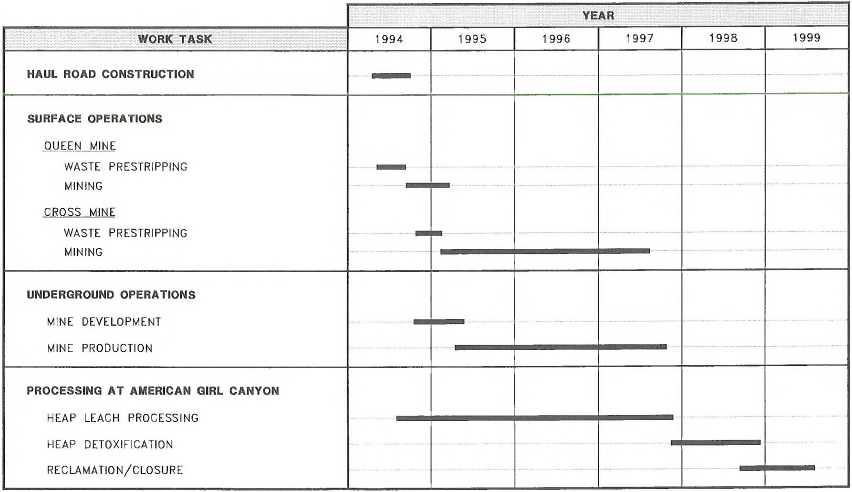


FIGURE S-3

PROPOSED ORO CRUZ PROJECT SCHEDULE

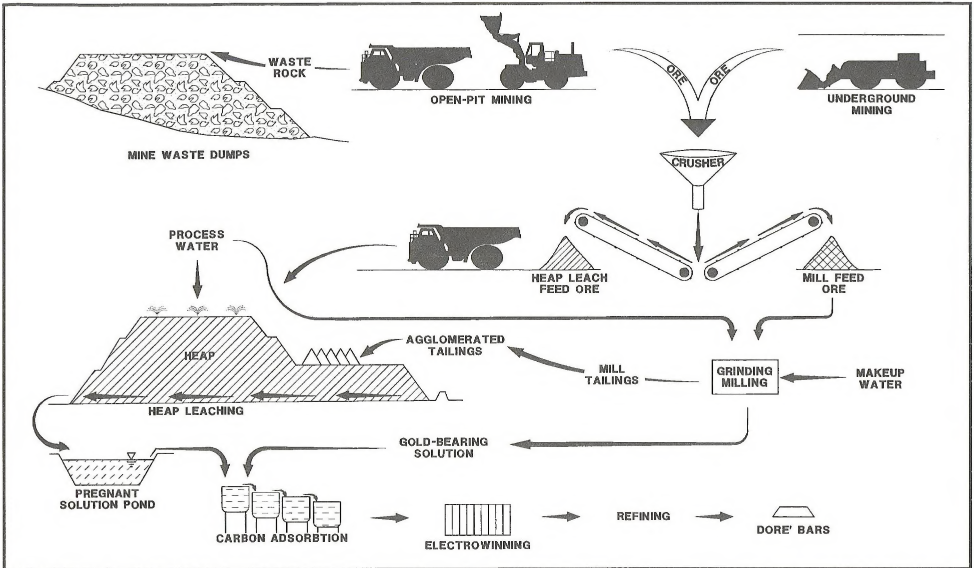


FIGURE S-4

SCHEMATIC DIAGRAM
OF PROCESS

TABLE S-1

PROJECTED FUTURE PRODUCTION FROM AMERICAN GIRL PROJECT
(by operation and type of mining)

	1993	1994	1995	1996	1994	TOTALS
PADRE MADRE SURFACE						
Ore Tons	99,000	0	0	0	0	99,000
Waste Tons	591,000	0	0	0	0	591,000
AGC SURFACE						
Ore Tons	683,000	0	0	0	0	683,000
Waste Tons	1,194,000	0	0	0	0	1,194,000
ORO CRUZ SURFACE						
Ore Tons	0	732,000	976,000	750,000	0	2,458,000
Waste Tons	0	3,468,000	3,291,000	1,700,000	0	8,459,000
AGC UNDERGROUND						
Ore Tons	233,900	233,000	0	0	0	466,900
Waste Tons	48,300	0	0	0	0	48,300
ORO CRUZ UNDERGROUND						
Ore Tons	0	0	225,000	250,000	25,000	500,000
Waste Tons	0	40,000	25,000	0	0	65,000

NOTE: AGC = American Girl Canyon

TABLE S-2

SUMMARY OF THE CUMULATIVE DIRECT IMPACT AREA AMERICAN GIRL PROJECT

		Acreage
Environmental Study Area	American Girl/Padre Madre Oro Cruz	2,100 4,300 6,400
American Girl Canyon Operation	Area of Direct Impact	379
Padre Madre Operation	Area of Direct Impact	239
Oro Cruz Operation	Oro Cruz Facilities Haul Road Aggregate Pit Subtotal	101 50 40 191
American Girl Project	Cumulative Area of Direct Impact	809

that the proposed action would result in unnecessary or undue degradation of Federal lands.

Prior to construction and operation of the proposed action, approval must be granted by the BLM because the operation is proposed on Federal lands administered by BLM. Possible BLM decisions on the proposed operation include approval as proposed by AGMJV in the POO, approval with modifications, or denying the proposed operation.

THE EIS PROCESS AND SCOPE OF THIS EIS

The National Environmental Policy Act (NEPA) establishes a national policy for the protection and enhancement of the environment. The Act directs Federal agencies to use a systematic interdisciplinary approach to environmental impact analysis, which ensures the integrated use of natural and social sciences and the design arts in planning and decision-making. NEPA requires that if any action taken by a governmental agency may "significantly affect the quality of the human environment," an EIS must be prepared. The addition of the proposed Oro Cruz operation to the American Girl Project will place the cumulative disturbed lands at over 640 acres. BLM has determined that due to the cumulative disturbance of over 640 acres, the presence of desert tortoise, the use of cyanide on Federal land, and the eligibility of the Tumco-Hedges area for the National Register of Historic Places, an EIS is required to analyze the possible effects from the proposed Oro Cruz operation and the cumulative effects of the overall American Girl Project.

The EIS process entails several steps. Scoping takes place first. During scoping, the public and other governmental agencies are afforded the opportunity in a public meeting format to express concerns and identify issues to be addressed within the Draft EIS. Written comments are also solicited. The proposed action and reasonable alternatives to the proposed action are clearly defined, based on BLM concerns and information presented by other agencies and the public. Elements of the environment which would be affected by the proposed action and alternatives are described within the EIS. An analysis of the consequences (impacts) of the proposed action and alternative actions is then conducted. The results of the analysis are documented in the Draft EIS. A formal public review and comment period occurs after publication of a Draft EIS, during which written and oral comments and questions on the analysis are solicited. A public meeting is held during this comment period affording an additional opportunity for public participation. Comments and questions received during the public comment period are reviewed and analyzed, and are incorporated into the Final EIS as appropriate.

In a Final EIS, BLM may modify alternatives, and substantive public comments are considered and addressed. When a decision has been reached, BLM must issue a Record of Decision (ROD) documenting the decision made and the reasons for such a decision.

This EIS provides an analysis of 3 types of impacts:

- *direct impacts from approval and implementation of the proposed Oro Cruz operation;*

- *cumulative impacts from the potential combined effects of the proposed Oro Cruz operation with the two existing American Girl Project components, Padre Madre and American Girl Canyon; and*

- *direct and cumulative impacts which would result from the implementation of alternatives to the proposed action.*

RELATIONSHIP TO BLM POLICIES, PLANS AND RESPONSIBILITIES

In addition to its NEPA responsibilities as discussed above, BLM must consider other laws, regulations, policies and plans in reviewing the Oro Cruz POO, including:

- *Federal Land Policy and Management Act*
- *U.S. Mining Laws and BLM Mining Regulations (43 CFR Part 3809)*
- *California Desert Conservation Area Plan*
- *Reclamation Plan Requirements*
- *Cyanide Management Plan Requirements*

BLM's roles and responsibilities for these laws, regulations, policies and plans are discussed in Chapter 1 of this EIS.

RELATIONSHIP TO OTHER GOVERNMENTAL POLICIES, PLANS AND RESPONSIBILITIES

In addition to BLM, other federal, state and local agencies have responsibilities in reviewing the proposed Oro Cruz operation. These other agencies include:

- *U.S. Fish and Wildlife Service*
- *State Historic Preservation Office*
- *Regional Water Quality Control Board*
- *County of Imperial*

Specific roles, responsibilities and concerns of these agencies and other governmental requirements are discussed in Chapter 1 of this EIS.

SCOPING AND PUBLIC PARTICIPATION

The environmental review procedures that guide the EIS process are prescribed by NEPA, Council on Environmental Quality (CEQ) regulations implementing NEPA, and BLM regulations and policies. All applicable laws and regulations guiding the EIS require both interagency and public involvement. This "scoping" process is used to identify the range of actions, alternatives, mitigation measures, and significant effects to be analyzed in depth within the EIS process. While scoping focuses the EIS process on significant effects, it also serves to eliminate from detailed study those issues found not to be of major consequence.

A Notice of Intent (NOI) to prepare an EIS for the proposed Oro Cruz operation was published in the Federal Register on Friday, June 5, 1992 (Federal Register, Vol. 57, No. 109). The NOI also announced the dates, times, and places for public scoping meetings which were held in El Centro, California and Yuma, Arizona. A Scoping Document was

developed to summarize the proposed action, BLM roles and responsibilities, the EIS process, and project schedule. The Scoping Document was made available to all persons who attended public meetings or who otherwise requested a copy.

The public scoping meetings were held on June 30, 1992 in El Centro and on July 1, 1992 in Yuma. No one attended the meeting in El Centro; 12 persons attended the meeting in Yuma. The NOI also served as notice to solicit written comments on the proposed Oro Cruz operation; the written comment period was from June 5 through July 17, 1992. Two comment letters, from the U.S. Bureau of Mines and the U.S. Environmental Protection Agency, were received by BLM during the written comment period. All comments received during the scoping period are addressed within this EIS.

SIGNIFICANT ENVIRONMENTAL ISSUES

Based on BLM's previous experience with the operating components of the existing American Girl Project, comments from the public, and comments from other governmental agencies, a list of potentially significant environmental issues was developed. These issues include:

- ***Wildlife*** *-- Nine Federal or state of California threatened, endangered, and candidate species are present, or potentially present within the project area. Issues include effects on these and other wildlife species from cumulative American Girl Project mining and processing operations, disturbances to wildlife habitat, and the effects from use of cyanide during processing.*

- ***Cultural Resources*** *-- From the mid-1880s to about 1920, the project area was the site of an important, though relatively unknown, mining boom. Cultural resources found within the historic communities known as Hedges/Tumco need to be identified and protected.*

- ***Visual Resources*** *-- While the location of the American Girl Project is within a relatively sparsely populated, remote area, historic mining scars and current project development can be seen from Interstate 8 and County Highway S34 (Ogilby Road).*

- ***Recreational Use/Public Safety*** *-- The major recreational uses within the study area are rockhounding, hiking, and visitation to the historic Hedges/Tumco communities. Effects on these recreational uses and public safety (e.g., access to cyanide, mining equipment, and other hazards) are potentially significant issues.*

- ***Cyanide Management*** *-- Sodium cyanide is a hazardous substance which is toxic to humans and wildlife. Issues include drip versus impact cyanide solution sprinklers, pond/ditch enclosures and wildlife mortality.*

- ***Reclamation*** *-- When mining and processing of ore ceases, the facilities and changes caused by mining must be decommissioned and reclaimed. Issues include the adequacy of proposed reclamation procedures, the practicality and consequences of backfilling mining pits, and*

reclamation bonding to insure adequate funds for future reclamation.

DEVELOPMENT OF ALTERNATIVES

In an EIS, the lead agency is required to evaluate the environmental effects of the proposed action and reasonable alternatives to the proposed action. The Draft EIS must consider the proposed action and the no action alternative.

Other alternatives consist of reasonable modifications to various elements of the proposal. These alternatives fall into two main categories -- those that modify the location of facilities and those that modify the methods and procedures to be employed in the operation. Comments from the public and other agencies, along with BLM experience and policies form the basis for consideration of alternatives to the proposed action. Alternatives considered for detailed study within this EIS have been developed to respond to potentially significant project impacts, and are related to the significant environmental issues. Some alternatives to the proposed action have been eliminated from detailed study for reasons relating to engineering design, economic feasibility, and adverse environmental impact. Table S-3 provides a summary of alternatives considered for detailed study compared to elements of the proposed action. Alternatives to the proposed action which are analyzed in this EIS are summarized below.

- ***Alternative 1 -- No Action.*** *This alternative means the continuation of existing management for the project area without approval of the proposed action. The general mining law allows, as a right, development of mineral resources on public land subject to the operation of the law. This right was amended with the passage of the Federal Land Policy and Management Act of 1976. Under terms of the law, BLM is mandated to disapprove a Plan of Operation if a finding of unnecessary or undue degradation is made.*

- ***Alternative 2 -- Complete Backfilling of Waste Rock.*** *The applicant has proposed partial backfilling of Oro Cruz waste rock with backfilling of waste rock into the proposed Queen pit. Alternative 2 would require complete backfilling of waste rock into mined-out pits so that there is no surface disposal of Oro Cruz waste rock. The Cross pit would not accommodate all of the remaining accumulated Oro Cruz waste. Therefore, in order to accomplish complete backfilling, waste would have to be hauled to American Girl Canyon pits in addition to the Oro Cruz Cross pit. Complete backfilling would involve loading and hauling 4.4 million tons of waste rock from the Oro Cruz waste dump to the Cross pit (a distance of 0.4 miles) with the remaining 3.0 million tons hauled to American Girl Canyon for disposal (2.9 miles).*

- ***Alternative 3 -- Cyanide Solution Application via Drip Emitters.*** *Heap leaching of gold ore is a process by which a gold-dissolving solution (dilute sodium cyanide) is percolated through the ore piled onto the lined heap leach pad. The Oro Cruz operation POO proposes the use of the existing heap leach at American Girl*

TABLE S-3

APPLICANT'S PROPOSAL AND SUMMARY OF POTENTIAL ALTERNATIVES

Operational Component	Applicant's Proposal	Alternatives to Proposed POO
Mining Operations	A combination of surface and underground mining is proposed. Rates of mining are based on equipment availability and processing thresholds.	1) Underground mine only* 2) Surface mine only* 3) Change in rate of mining*
Processing Operations	Due to wide variation in ore grade, both milling and heap leaching is proposed to obtain economical gold recovery. Rates of processing are based on crushing and milling design capacity, typical leach cycle times, and equipment availability.	1) Mill operations only (using existing mill at American Girl Canyon)* 2) Heap leach operations only* 3) Change in rate of processing* 4) Ore processing offsite*
Facility and Component Location	Two economic surface mining pits have been identified and are proposed for mining. One economic underground mining target beneath the Cross pit is also proposed for mining. To avoid environmental impacts and project costs, AGMJV proposes to use existing processing facilities at American Girl Canyon, necessitating a haul route between Oro Cruz and American Girl Canyon. The proposed waste rock dump site is based on avoidance of impacts to cultural, wildlife, mineral and visual resources.	1) Different location of pits and underground components* 2) All project facilities to be located at Oro Cruz (Oro Cruz to be developed as a stand-alone facility without the use of mill and heap leach at American Girl Canyon)* 3) Different waste rock dump location* 4) Haul route to American Girl Canyon mill using Ogilby Road*
Waste Rock Management	The applicant proposes a partial backfilling scenario in which the Queen pit would be backfilled. The Cross pit is not proposed for backfilling, requiring surface disposal of waste rock.	1) Complete backfilling of waste rock.
Heap Leach Design	The applicant proposes to continue processing at the heap leach at American Girl Canyon using existing techniques.	1) Change in design of heap leach facility.*
Electrical Power Supply	AGMJV proposes to use the existing facility at American Girl Canyon to generate electricity with a powerline constructed to Oro Cruz along the haul road.	1) Construction of substation and power lines to site*
Water Source and Supply	Use of water in flooded underground workings (obtained from a dewatering program) and groundwater from a well southwest of American Girl Canyon (via a waterline) is proposed for use at Oro Cruz.	1) Truck or pipe water from another source*
Cyanide Management	AGMJV proposes to continue existing cyanide management procedures at American Girl Canyon including application by impact sprinkler and use of netting to cover cyanide solution.	1) Drip application of cyanide solution 2) Floating cover over ponds containing cyanide solution

* Eliminated from detailed NEPA analysis

Canyon. Original American Girl Canyon operating plans called for cyanide solution application on the heap leach via drip emitters as used in the Padre Madre heap leach facility. When the mill in American Girl Canyon became operational in 1990, the operation began experiencing excessive accumulations of water in the barren pond which receives solution discharged from the carbon plant circuit. The immediate response to this water problem was to implement the use of evaporative spray impact sprinklers for cyanide solution application. AGMJV has proposed the continued use of impact sprinkler application at American Girl Canyon for Oro Cruz ore. Because of the original permit terms, the potential for reducing the use of water, and the potential for reducing possible exposure of wildlife to adverse effects from cyanide, application of cyanide solution via drip emitters rather than sprinklers is analyzed in this EIS as Alternative 3.

- ***Alternative 4 -- Floating Cover on Ponds Containing Cyanide Solution.*** *The heap leach facilities for the proposed Oro Cruz gold recovery operation at the existing American Girl Canyon consist of the lined pad and two double-lined solution ponds (the barren pond and the pregnant pond). The barren and pregnant solution ponds are part of an overall closed circuit, zero discharge facility with full leakage detection systems in place. With current operations at American Girl Canyon and Padre Madre, netting is used as the primary tool to restrict access to cyanide solutions. AGMJV has proposed to continue use of netting at American Girl Canyon during Oro Cruz processing operations. The utilization of a floating cover on the American Girl Canyon open ponds to prevent exposure of wildlife to cyanide solutions rather than netting is considered in this EIS as Alternative 4.*

- ***BLM's Preferred Alternative.*** *Based on the results of environmental analysis as documented within this EIS, BLM has identified its Preferred Alternative for mining and processing Oro Cruz ore. The Preferred Alternative combines elements of the Oro Cruz operation as proposed by AGMJV and Alternative 3 -- Cyanide Solution Application via Drip Emitters. The Preferred Alternative would allow mining and processing of Oro Cruz ore as proposed by AGMJV, but would require drip cyanide solution application. with conditions whereby application via impact sprinklers would be allowed in some circumstances. Use of impact sprinklers under specific circumstances would be authorized to allow AGMJV to maintain operational control of pond levels, chemistry and metallurgy. Conditions under which AGMJV would be allowed to return to sprinkler application of cyanide solution involve significant events of:*

  - *rainfall amounts which jeopardize pond capacities,*
  - *reduction in filtration efficiency causing a major increase in soluble gold loss,*
  - *reduction in filtration efficiency causing a major increase in moisture content,*
  - *increases in copper content within heap leach or mill pregnant solutions causing a chemical*

imbalance jeopardizing process efficiency and effectiveness.

These conditions are described in more detail in Chapter 4 of this EIS.

EXISTING ENVIRONMENT

The Oro Cruz operation of the American Girl Project is proposed to occur in a relatively remote area of southeastern California in Imperial County. Vegetation is sparse, with high temperatures and low precipitation restricting land and resource uses. The vast majority of land is open space. Historically, the American Girl Project area has been principally used for mining and prospecting. There are numerous historic gold mines or prospects in the Cargo Muchacho Mountains, some of which were major gold producers. In addition to the gold mineralization, the area also has uranium, geothermal, mica, and kyanite (aluminum silicate) resources. There is a considerable amount of surface disturbance as a result of past mining activity. These historic disturbances are an important feature of the existing environment.

The study area for this EIS is the entire American Girl Project area. Because the existing environment for the Padre Madre and American Girl Canyon operations have been described in previous BLM environmental analyses, and because Oro Cruz is the operation currently being proposed to BLM and other regulatory agencies, the focus of this EIS is the proposed Oro Cruz disturbance area.

Elements of the human environment discussed in the EIS include:

- *Climate and Air Quality*
- *Geology*
- *Hydrology*
- *Soils*
- *Vegetation*
- *Wildlife*
- *Land Use*
- *Recreation*
- *Visual Resources*
- *Sound*
- *Cultural Resources*
- *Transportation*
- *Socioeconomics*

Elements of the human environment such as Areas of Critical Environmental Concern, Farmlands, Wetlands, Wild and Scenic Rivers and Wilderness do not exist in the project vicinity and are therefore not discussed in the EIS.

CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

An analysis of the potential environmental and socioeconomic consequences that would result from implementation of AGMJV's proposed action or the alternatives is provided in Chapter 4 of this EIS. For the purposes of this EIS, environmental impact is defined as a modification in the status of the environment as it presently exists or as it is anticipated to be in the future as a result of the proposed action or alternatives. Environmental

impacts can be positive (beneficial) or negative (adverse), as a result of the action (direct) or as a secondary result (indirect), and can be long-term or short-term in duration. Impacts can vary in degree or magnitude from no change, or a change which does not constitute a substantially adverse impact on the environment and related resources (not significant), to an identifiable major adverse change in the environment (significant).

As used in NEPA, "significant" impacts are defined by their context and intensity. Generally, impacts are identified in the context of the project area, and the extent these impacts are perceptible beyond the project area. Intensity relates to the degree of the effect on public health, safety, and unique characteristics of the area, and the degree of controversy or risk. Impacts may be insignificant individually but significant when added together. An impact which violates a law imposed for the protection of the environment is generally significant.

Quantitative levels of adverse impacts for assessment of impact magnitudes include:

- ***High adverse impact*** *-- a high impact would result if proposed activities would potentially cause a substantial adverse change or stress to an environmental resource or resources;*

- ***Moderate adverse impact*** *-- a moderate impact would result if proposed activities would potentially cause some identifiable adverse change or stress to an environmental resource or resources;*

- ***Low adverse impact*** *-- a low impact would result if proposed activities would potentially cause an insubstantial or small adverse change or stress to an environmental resource or resources.*

Anticipated impacts for the proposed action and the five alternatives to the proposed action are analyzed in this EIS.

Table S-4 shows a summary of potential consequences from the Oro Cruz operation as proposed by AGMJV. The level of projected adverse impact would be low in all areas except for air quality, wildlife, visual resources, and cultural resources. Impacts to these elements of the human environment are discussed below.

- ***Air Quality*** *-- Potential emissions of small particulates (PM_{10}) and nitrous oxides (NO_x) from the proposed action would have a moderate level of impact. These impacts would be mitigated so that they would not be significant.*

- ***Wildlife*** *-- Hazards to wildlife from the use of cyanide and effects on the desert tortoise would have potential moderate adverse impacts. These impacts would be mitigated so that they are not significant. Effects on the California leaf-nosed bat (Macrotus) would have a high level of adverse effects because of the destruction of the maternity and winter roost in the historic*

TABLE S-4

SUMMARY OF POTENTIAL ORO CRUZ IMPACTS
(Operation as Proposed by AGMJV)

	Level of Projected Adverse Impact			
	Low	Moderate	High	Significant
Air Quality		x		
Geology and Topography	x			
Hydrology	x			
Land Use	x			
Vegetation	x			
Wildlife		x	x	x
Land Use	x			
Recreation	x			
Visual Resources		x		
Sound	x			
Cultural Resources		x		
Transportation	x			
Socioeconomics	x			
Hazards from use of Cyanide	x			

Golden Queen mine. These impacts would be mitigated but would still be significant.

- ***Visual Resources** -- The proposed action would result in moderate visual effects from the Cross and Queen pit highwalls, the Oro Cruz waste rock dump, and the American Girl Canyon heap leach. The potential visual contrasts have been rated moderate according to the BLM Visual Rating Management system, and would not exceed the California Desert Conservation Area Plan Class M (Moderate) visual objectives. Impacts would not be significant.*

- ***Cultural Resources** -- Although the proposed action would result in the destruction of the historic Golden Queen and Golden Cross pits and underground mine workings, no direct adverse effects would occur to the important cultural resources within the Hedges/Tumco historic townsite, which is eligible for inclusion into the National Register of Historic Places (NRHP). The Golden Queen and Golden Cross mines do not significantly contribute to the Hedges/Tumco Townsite NRHP eligibility. There are no other cultural resources within the proposed Oro Cruz operational area which are eligible for the NRHP. Therefore, overall*

impacts to cultural resources would have a moderate adverse effect. Impacts would not be significant.

Effects from alternatives compared to the proposed action are summarized below:

- ***Alternative 1 (No Action)*** *-- This alternative would eliminate those impacts which the proposed action would generate. BLM can implement the No Action Alternative only if the proposed action would result in a finding of unnecessary or undue degradation of Federal lands.*

- ***Alternative 2 (Complete Backfilling of Oro Cruz Waste Rock)*** *-- This alternative would reduce visual and topographic impacts by eliminating surface disposal of waste rock; extend the reclamation life of the project by 3 years; and cost over $3.5 million for AGMJV to implement. Visual effects would still be moderate, since the Cross pit highwall could only be reduced 50 percent.*

- ***Alternative 3 (Cyanide Solution Application Via Drip Emitters)*** *-- This alternative would lesson effects on wildlife by reducing the potential for cyanide solution ponding on the American Girl Canyon heap leach compared to sprinkler application; eliminate operational flexibility for AGMJV to control metallurgical accounting procedures, water balance, and copper levels during processing through use of sprinklers; and cost an estimated $25,000 for AGMJV to implement. Adverse effects on wildlife from potential exposure to cyanide would be reduced from moderate to low.*

- ***Alternative 4 (Floating Cover Over Ponds Containing Cyanide Solution)*** *-- This alternative would lessen effects to wildlife by providing total exclusion of wildlife access to cyanide in ponds and eliminate the potential for wildlife getting caught in netting; eliminate evaporative loss from pond surfaces potentially creating a process water balance problem; and cost about $210,000 for AGMJV to implement. Adverse effects on wildlife from potential exposure to cyanide would still be moderate since proper sizing and implementation of mesh netting the proposed action would be as effective as a floating cover.*

- ***BLM's Preferred Alternative (Drip Application of Cyanide Solution with Conditions for Use of Sprinkler Application)*** *-- This alternative would lessen effects on wildlife by reducing the potential for cyanide solution ponding on the American Girl Canyon heap leach and cost about $25,000 for AGMJV to implement (the same as Alternative 3); but would provide for use of impact sprinklers in limited areas under specific conditions to control water balance, metallurgical accounting, and copper level problems (different than Alternative 3). Adverse effects on wildlife from potential exposure to cyanide would be reduced from moderate to low.*

CUMULATIVE IMPACTS

Cumulative impacts are defined by Council on Environmental Quality regulations as " ... the impact on the environment which results from the

incremental impact of the action when added to other past, present, or reasonably foreseeable future actions..." Elements of the cumulative environment can be located adjacent to or within the proposed action study area, or can be more regional in nature.

The 3 major elements within or adjacent to the Oro Cruz study area affecting the cumulative environment are:

- ***Current AGMJV Mining Activities*** *-- The existing American Girl Project consists of the Padre Madre and American Girl Canyon operations, which are located south of the proposed Oro Cruz operation. Implementation of the proposed Oro Cruz operation would extend the scope and timing of the overall American Girl Project. With Oro Cruz, the overall American Girl Project would increase disturbance by an additional 191 acres, bringing the cumulative projected disturbance to 809 acres; extend the life of the overall project by 2-3 years; and produce an additional 3 million tons of ore and 8.5 million tons of waste rock compared to current operations at Padre Madre and American Girl Canyon.*

- ***Historic Mining-Related Disturbances*** *-- The American Girl Project vicinity is an area of historic mining activity. Evidence of surface prospecting and remnants of historical mining and ore processing facilities is abundant in the area.*

- ***Recreation Activities*** *-- Primarily because of the historic mining activities (e.g., the Hedges/Tumco historic townsite) in the area, the American Girl Project vicinity is of interest to recreationalists who have traditionally used the area for sightseeing, off-road vehicle use, rock hounding and camping.*

These three factors are considered throughout the impact analysis described in Chapters 4 and 5 of this EIS.

Existing and proposed regional projects considered in the cumulative environment in this EIS include:

- *Existing Mesquite Mine*
- *Proposed Mesquite Regional Landfill*
- *Proposed Chocolate Mountain Regional Landfill*
- *Proposed Calexico East Border Station and State Route 7*
- *Proposed East Mesa Recharge and Recovery Wells*
- *Proposed El Centro Intermodal Loading Facility*
- *Proposed Southern Arizona Transmission Project*
- *Proposed Tamal Energy Co-Generation Project*
- *Proposed All American Canal Lining Project*

The proposed action, when considered in conjunction with the projects listed above, would result in potential impacts to ground water resources in the Amos-Ogilby alluvial basin, and biological resources, primarily desert tortoise habitat. Cumulative impacts to other elements of the human environment would be similar in nature and extent to those projected for the proposed action by itself (see Table S-4) due to the wide geographic distribution of these projects throughout the region.

Overall, the magnitude of cumulative adverse impacts would be similar to the levels of site-specific effects shown in Table S-4 for each element of the human environment.

CHAPTER 1
INTRODUCTION

This Draft Environmental Impact Statement (EIS) describes the possible environmental consequences of the proposed Oro Cruz operation of the American Girl Project. The Oro Cruz operation would consist of new underground and surface gold mining and use existing gold ore processing facilities in the Cargo Muchacho Mountains in Imperial County, California near the Arizona border (see Figure 1). The American Girl Project currently consists of two adjacent operating components, the Padre Madre operation and the American Girl Canyon operation. The Oro Cruz operation would thus be the third operating component of the American Girl Project.[1]

THE EXISTING AMERICAN GIRL PROJECT

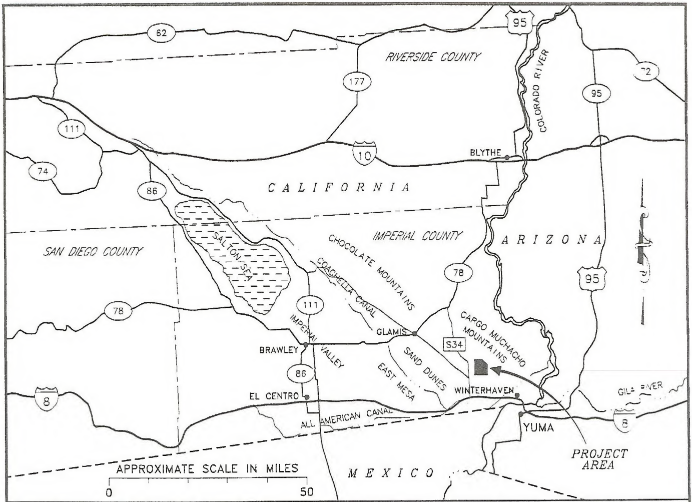
The American Girl Project is a gold mining and processing operation owned by the American Girl Mining Joint Venture (AGMJV). American Girl Mining Joint Venture is a joint venture of MK Gold Company, a wholly owned subsidiary of Morrison-Knudsen Corp. (M-K), and Eastmaque Gold Mining Ltd., a wholly owned subsidiary of Equinox Resources, Ltd. (Equinox). M-K is an 85-year old publicly held company headquartered in Boise, Idaho. M-K had annual consolidated gross revenues of over 2.3 billion in 1992 and is involved with eight mining operations in the U.S. Equinox is a Vancouver based company established in 1985 and publicly traded on the Vancouver, Toronto and NASDAQ Stock Exchanges. Equinox has a number of mining and exploration properties throughout western North America.

The American Girl Project currently consists of two components: the Padre Madre operation and the American Girl Canyon operation. The Project is currently in its sixth year of operation in the Cargo Muchacho Mountains of eastern Imperial County, California. During the six year period, four Plans of Operation (POOs) have been approved by the Bureau of Land Management (BLM):

- *November 1986 (amended 1/87) - Padre Madre Test Phase*
- *October 1987 (amended 8/88 and 9/89) - Padre Madre Full Scale Operation*
- *May 1987 - American Girl Canyon Underground Development*
- *December 1989 (amended 3/91, 1/92 and 1/93) - American Girl Canyon Full Scale Operation*

The POO and Conditional Use Permit (CUP) for each of the above Project phases was approved by the BLM and the Imperial County Planning Department

[1] Throughout this EIS the terms "Oro Cruz operation" and "proposed operation" refer specifically to the activities which would occur at the Oro Cruz site if approved by regulatory agencies. The terms "American Girl Project" and "project" refer specifically to the overall Project including the existing Padre Madre and American Girl Canyon operations, plus the proposed Oro Cruz operation if it is approved. In other words, the Padre Madre and American Girl Canyon operations comprise the existing project and the sum of Oro Cruz, Padre Madre and American Girl Canyon comprises the future project if Oro Cruz is approved and implemented.



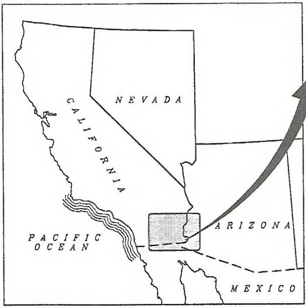


FIGURE 1

GENERAL SITE LOCATION

(County) based on a Finding of No Significant Impact (FONSI) and a Negative Declaration, respectively. The FONSIs and Negative Declarations were made after preparation of environmental analysis documents for each proposed Project phase to comply with the requirements of the National Environmental Policy Act (a BLM requirement) and the California Environmental Quality Act (a County requirement).

THE PROPOSED ACTION

The need for additional ore reserves has led AGMJV to propose the development of the Oro Cruz property, located approximately 2.5 miles north of the existing American Girl Canyon facilities. If approved, the Oro Cruz operation would thus become the third component of the American Girl Project. Like Padre Madre and American Girl Canyon, the Oro Cruz operation would be operated and controlled by AGMJV.

The Oro Cruz property consists of unpatented lode and placer claims located entirely on lands administered by the BLM. See Appendix A for relevant claim boundary maps. All claims affected by the operation are controlled by AGMJV through direct ownership or various lease arrangements. The area has a long history of mining and mineral exploration activities that has left the property with considerable surface disturbance. The exploration activities that have been conducted by AGMJV and previous property holders have delineated both surface and underground targets. Because of AGMJV's ability to develop the Oro Cruz property in conjunction with the American Girl Canyon operation, the Oro Cruz operation would be limited to the mining of surface and underground deposits, haul roads, and waste rock disposal facilities. As proposed by AGMJV, Oro Cruz ore processing by heap leaching and milling would be conducted within the existing and approved American Girl Canyon operational area.

Initial mining from the Oro Cruz operation is proposed to be conducted via two open-pits, the Cross and the Queen Pits. The ore and waste rock would be extracted by using front-end loaders and trucks in the same manner as Padre Madre and American Girl Canyon open pits. In fact, mining from all operations would be phased so that much of the same equipment can be employed, with no nominal increase in daily ore production. Once surface mining is completed the Cross pit is proposed for use as access for underground mining.

Surface mining at Oro Cruz is proposed to begin in spring 1994 and would continue for three years, with 2.5 million tons of ore and 8 million tons of waste rock being produced. As proposed, the underground development would result in 500,000 tons of ore being produced. Underground development would begin in late 1994, with full scale production in 1995. The higher and lower grade ores would be segregated during mining and treated separately for processing. The lower grade ore would be crushed at the existing American Girl crusher and hauled to the existing leach pad in the American Girl Canyon. Virtually all of the underground ore and approximately 600,000 tons (between 15 to 20 percent) of the surface ore would be hauled to the existing crusher and processed in the existing conventional cyanide mill at American Girl Canyon. The mill tailings would be agglomerated and placed on the American Girl Canyon heap leach. The proposed Oro Cruz

operation is described in more detail in Chapter 2 of this EIS.

PURPOSE AND NEED

Purpose and Need for the Proposed Action

Gold is a precious metal for which there is worldwide demand. AGMJV owns or controls unpatented mining claims in the Oro Cruz area which overlie ore that contains gold. The purpose of the proposed action is to extract this ore from two open pits and an underground mine, and process the ore using both milling and heap leaching techniques. The resulting product, dore' bars, would be a salable commodity containing gold and other precious metals. AGMJV has designed the proposed action to satisfy the need to produce this salable commodity in a prudent and profitable manner.

In addition to the proposed mining and processing techniques, the applicant has proposed a number of environmental protection and reclamation initiatives in order to comply with BLM and other public agency laws and regulations. AGMJV has the legal right to mine and process these gold resources according to U.S. mining law unless environmental laws or regulations would be violated, or BLM determines that the proposed action would result in unnecessary or undue degradation of Federal lands.

Purpose of this EIS

Prior to construction and operation of the Oro Cruz operation, approval must be granted by the BLM because the operation is proposed on Federal lands administered by BLM. A POO describing the proposed Oro Cruz operation was submitted to BLM in June, 1992 and supplemented in February and May, 1993. Possible BLM decisions on the proposed operation include approval as proposed in the POO, approval with modifications, or denying the proposed operation. Within this EIS, the impacts of proposed actions by AGMJV and alternatives are carefully weighed and evaluated. This Draft EIS embodies and documents the process to be used by BLM to make a decision on the proposed mining and processing operation. It is the product of many hours of review and analysis by agency officials and technical specialists. Public participation was an important component of the process. Environmental issues expressed by the public and governmental agencies in meetings and in written comments to BLM have been incorporated into this analysis.

THE EIS PROCESS AND SCOPE OF THE EIS

NEPA and the EIS Process

The National Environmental Policy Act (NEPA) establishes a national policy for the protection and enhancement of the environment. The Act directs Federal agencies to use a systematic interdisciplinary approach to environmental impact analysis, which ensures the integrated use of natural and social sciences and the design arts in planning and decision-making. NEPA requires that if any action taken by a governmental agency may "significantly affect the quality of the human environment," an EIS must be prepared. The addition of the Oro Cruz operation to the American Girl Project will place the cumulative

disturbed lands at over 640 acres. BLM has determined that due to the cumulative disturbance of over 640 acres, the presence of desert tortoise, the use of cyanide on Federal land, and the eligibility of the Tumco-Hedges area for the National Register of Historic Places, an EIS is required to analyze the possible effects from the Oro Cruz operation and the cumulative effects of the overall American Girl Project.

Procedures governing the EIS analysis process were initially established with the passage of NEPA in 1969. This Draft EIS was written to meet the requirements of this statute, the regulations implementing NEPA adopted by the Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508), and policies and procedures adopted by BLM to implement NEPA as described in its NEPA Handbook (BLM Handbook H-1790-1).

The EIS process entails several steps. Scoping takes place first. During scoping, the public and other governmental agencies are afforded the opportunity in a public meeting format to express concerns and identify issues to be addressed within the Draft EIS. Written comments are also solicited. The proposed action and reasonable alternatives to the proposed action are clearly defined, based on BLM concerns and information presented by other agencies and the public. Elements of the environment which would be affected by the proposed action and alternatives are described within the EIS. An analysis of the consequences (impacts) of the proposed action and alternative actions is then conducted. The results of the analysis are documented in the Draft EIS. A formal public review and comment period occurs after publication of a Draft EIS, during which written and oral comments and questions on the analysis are solicited. A public meeting is held during this comment period affording an additional opportunity for public participation. Comments and questions received during the public comment period are reviewed and analyzed, and are incorporated into the Final EIS as appropriate.

In a Final EIS, BLM may modify alternatives, and substantive public comments are considered and addressed. When a decision has been reached, BLM must issue a Record of Decision documenting the decision made and the reasons for such a decision.

Scope of this EIS

Implementation of the Oro Cruz operation would extend the cumulative operating life and area of disturbed impact beyond the currently approved Padre Madre and American Girl Canyon operations. While the Oro Cruz operation would disturb a separate geographical area than the two existing operations, Oro Cruz is linked to Padre Madre and American Girl Canyon through proximity of operations, common ownership and control, and the sharing of equipment, processing facilities, personnel and other resources.

This EIS provides an analysis of 3 types of impacts:

- *direct impacts from approval and implementation of the proposed Oro Cruz operation;*
- *cumulative impacts from the potential combined effects of the proposed Oro Cruz operation with the two existing American Girl Project components, Padre Madre and American Girl Canyon; and*

- *direct and cumulative impacts which would result from the implementation of alternatives to the proposed action.*

Chapter 2 of the EIS provides detailed descriptions of the proposed action, alternatives to the proposed action, and factors affecting the cumulative environment.

RELATIONSHIP TO BLM POLICIES, PLANS AND RESPONSIBILITIES

In addition to its NEPA responsibilities as discussed above, BLM must consider other policies, plans and responsibilities in reviewing the Oro Cruz POO, as summarized below.

Federal Land Policy and Management Act

The lands to be affected by the proposed Oro Cruz operation are public lands administered by the BLM. Additionally, the vast majority of lands affected by the existing Padre Madre and American Girl Canyon operations of the American Girl Project also are lands administered by BLM. BLM policies, plans, programs and responsibilities, based on the Federal Land Policy and Management Act (FLPMA) of 1976, recognize that public lands are an important source of the nation's mineral and energy resources. BLM is responsible for making public lands available for a wide range of uses that include the orderly and efficient development of mineral and energy resources, recreation, and wildlife/fisheries conservation. If no unnecessary or undue degradation associated with the proposed Oro Cruz operation is found to exist by BLM, the proposed operation would conform to FLPMA requirements.

U.S. Mining Laws and BLM Regulations

In the case of mineral development projects on public lands, "need" for a proposed project is established by virtue of the fact that the federal government has allowed the filing of mining claims. United States mining laws and the regulations by which they are enforced recognize the statutory right of mining claim holders to develop mineral resources on Federal lands. BLM responsibilities for reviewing a POO are spelled out in BLM regulations (43 CFR Part 3809; Surface Management Under the General Mining Laws). Submission of a POO for the Oro Cruz operation also initiated the NEPA compliance process which requires BLM, the lead Federal agency, to evaluate environmental concerns during review of the POO. The BLM will use the final EIS to take action on the proposed POO.

BLM's environmental review as embodied in this EIS is a full and fair disclosure of possible impacts of the proposed action, and an effort to ensure that:

- *adequate provisions are included to minimize, where feasible, adverse environmental impacts on public lands surface resources,*
- *measures are included to provide for reasonable reclamation, and*
- *the proposed operations comply with other applicable federal and state laws and regulations.*

The BLM is required by federal regulations to approve any operations as long as such activities

would not cause unnecessary or undue degradation to the public lands (43 CFR 3809.0-6). BLM may place operating conditions on the project to minimize environmental impacts.

California Desert Conservation Area Plan

The American Girl Project area is managed by BLM through terms of the California Desert Conservation Area (CDCA) Plan (BLM, 1980). Preparation of the Plan was mandated by FLPMA Section 601. "The goal of the plan is to provide for the use of the public lands and resources of the California Desert Conservation Area, including economic, educational, scientific, and recreational uses, in a manner which enhances wherever possible - and which does not diminish, on balance - the environmental, cultural, and aesthetic values of the Desert and its future productivity."

Based on an inventory of resources within the 25 million acre CDCA, lands were classified according to four multiple use classes. The American Girl Project area (including Oro Cruz) was classified as multiple use Class M, which provides for a wide variety of uses such as mining, livestock grazing, recreation, energy and utility development. The proposed action would be in conformance with the multiple use class guidelines for this classification.

Reclamation Plan Requirements

The Mining and Mineral Policy Act of 1970 (MMPA) states that the federal government should promote the "development of methods for the disposal, control, and reclamation of mineral waste products, and the reclamation of mined land, so as to lessen any adverse impact of mineral extraction and processing upon the physical environment that may result from mining or mineral activities." Therefore, it is a statutory mandate that BLM ensure that reclamation and closure of mineral operations be completed in an environmentally sound manner.

The BLM's long-term reclamation goals are to shape, stabilize, revegetate, or otherwise treat disturbed areas in order to provide a self-sustaining, safe, and stable condition that provides a productive use of the land which conforms to the approved land-use plan for the area. The short-term reclamation goals are to stabilize disturbed areas and to protect both disturbed and adjacent undisturbed areas from unnecessary or undue degradation. BLM has prepared a Solid Minerals Reclamation Handbook (BLM, 1992a) to provide consistent reclamation guidelines for all surface-disturbing activities, including mineral activities, conducted under BLM authority. BLM will review the reclamation portion of the Oro Cruz POO to ensure BLM's environmental protection responsibilities are carried out.

Cyanide Management Plan Requirements

The proposed Oro Cruz operation, like the two existing components of the American Girl Project, would use cyanide heap leaching and milling as gold recovery processes. The BLM's national cyanide management policy requires the BLM State Offices to prepare a Cyanide Management Plan (BLM, 1992b). A Cyanide Management Plan was prepared in 1992 by the BLM California State Office. The plan applies to all BLM lands in California and administered by the BLM California State Office. The objectives of the Cyanide Management Plan are to:

- *ensure that mining operations using cyanide on BLM managed lands follow best management practices and do not cause unnecessary or undue degradation of the federal lands,*

- *provide both the mine operator and the BLM technical staff with standards for development and evaluation of mining projects that use cyanide, and*

- *use State standards, if established.*

The Plan does not duplicate requirements of other federal or state agencies with responsibility to the use of cyanide in mining operations. Accordingly, where standards are established for mining operations by California Regional Water Quality Control Boards, such standards shall apply when BLM is reviewing a POO. BLM will review the proposed Oro Cruz operation POO to ensure that it is in compliance with the Cyanide Management Plans.

RELATIONSHIP TO OTHER GOVERNMENTAL POLICIES, PLANS and RESPONSIBILITIES

In addition to BLM, other federal, state and local agencies have responsibilities in reviewing the proposed Oro Cruz operation, as summarized below. A list of permits and approvals (in addition to approval of the POO by BLM) necessary for Oro Cruz implementation is included in Table 1.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) administers the Endangered Species Act. The BLM will prepare a Biological Assessment (BA) to comply with Section 7 of the Act. Following its submittal, the USFWS will prepare a Biological Opinion on the project impacts and any cumulative impacts from other activities occurring in the same area. The proposed Oro Cruz operation could not proceed if the USFWS decides, in its official opinion, that the project as mitigated would jeopardize the continued existence of a threatened or endangered species.

California Department of Fish and Game

The California Department of Fish and Game will participate in the Endangered Species Act consultation between the BLM and USFWS.

The National Historic Preservation Act and the State Historic Preservation Office

BLM must consult with the State Historic Preservation Office (SHPO) when potentially significant historical, archaeological, or other cultural resources could be affected by proposed development. Under Section 106 of the National Historic Preservation Act, evaluation of all potential impacts to cultural resources within the Area of Potential Effect is required for all alternatives. If the proposed action or an alternative is approved, the SHPO would concur in a BLM determination of No Adverse Effect. BLM would oversee compliance with historic preservation and monitoring plans.

TABLE 1

OTHER PERMITS AND APPROVALS

FOR ORO CRUZ DEVELOPMENT

AIR	New Source Review: Imperial County Air Pollution Control District, El Centro Authority to Construct and Permit to Operate: Imperial County Air Pollution Control District, El Centro Air Toxics Inventory and Report: Imperial County Air Pollution Control District, El Centro Burning Permit: Imperial County Air Pollution Control District, El Centro
WATER/WASTEWATER	Waste Discharge Order: California Regional Water Quality Control Board, Colorado River Basin Region, Palm Desert
OPERATIONS	SMARA Approval of Mining and Reclamation Plan: Imperial County Planning Department, El Centro Emergency Fire, Evacuation and Rescue Plans: Department of Labor, Mine Safety and Health Administration Notice of Start of Operations: Department of Labor, Mine Safety and Health Administration
RECLAMATION	Reclamation Bond: • BLM, El Centro • Imperial County • California Regional Water Quality Control Board, Colorado River Basin Region, Palm Desert • California Division of Mines and Geology
CONSTRUCTION	Building Permits: Imperial County Planning Department, El Centro
CONSTRUCTION WITHIN DRY WASH	Approval: California Department of Water Resources
SEPTIC SYSTEM	Approval: Imperial County Department of Health Services, El Centro
CULTURAL RESOURCES	Concurrence: State Historic Preservation Officer
WILDLIFE	Biological Consultation on Threatened and Endangered Species: U.S. Fish and Wildlife Service and California Department of Fish and Game

Regional Water Quality Control Board

In California, the Regional Water Quality Control Boards (RWQCB) regulate mines under Article 7 of Chapter 15 of Division 3 of Title 23 of the California Code of Regulations. The primary purpose of these regulations is to carry out the statutory mandate of the Porter-Cologne Water Quality Act (Water Code) which is to protect the beneficial uses of the waters of the State. Chapter 15 regulates the discharges of waste to land under a non-degradation policy (Resolution 68-16). Dischargers are required to assess the physical and chemical characteristics of mining waste for purposes of classification, comply with minimum prescriptive standards when constructing waste management units for waste of a particular classification, monitor the units and water of the State to ensure that the units are not leaking, and maintain the closed units to ensure that waters of the State are protected from degradation. The Regional Boards have established water/wastewater discharge requirements for American Girl Project operations, including spent heap leach ore, tailings and waste rock, specifying containment for mining waste management units including active heap leach pads, and specifying monitoring requirements including heap leach detoxification and closure. These requirements would be modified to include potential discharges that would result from the proposed action.

California Surface Mining and Reclamation Act

All mining activities, including those on federal lands, must comply with California Surface Mining and Reclamation requirements, as established by the California Surface Mining and Reclamation Act of 1975 (SMARA) (California Public Resources Code, Chapter 9, Division 2). The California Division of Mines and Geology (CDMG) is the oversight agency for the SMARA program which is implemented by local enforcement agencies, usually counties. The Imperial County Planning Department, with oversight from CDMG, will measure compliance of the proposed Oro Cruz Reclamation Plan in accordance with SMARA requirements (see Imperial County below).

County of Imperial

Cyanide operations involving federal lands in California are managed in cooperation with counties in accordance with SMARA per a general Memorandum of Understanding (MOU). The Imperial County Planning Department has jurisdiction over the Oro Cruz Reclamation Plan under terms of SMARA, and will use this EIS as one basis for evaluating compliance with SMARA. Additionally, the County Health Department and the Regional Air Pollution Control District have environmental protection responsibilities including water protection, air protection, and public health and safety for the Oro Cruz operation. The proposed action would be in compliance with the County General and Land Use Plans.

Reclamation Costs and Bonding

To guarantee completion of project reclamation, a bond is required by SMARA. Bonding of reclamation procedures is also permitted under various land management regulations, and BLM policy requires bonding for all approved mining operations on public land. The Regional Water Quality Control

Board also requires bonding. If approved, the final bond amount for Oro Cruz reclamation would be jointly determined by BLM, Imperial County, the California Division of Mines and Geology, and the Regional Water Control Board based upon the final design plans for the acreage to be disturbed and the projected costs of closure and reclamation.

Environmental Health and Safety

Health and safety are important considerations during all aspects of a mining operation. Regulations to protect worker health and safety are set forth by the Mine Safety and Health Administration (MSHA) and the Occupational Safety and Health Administration (OSHA) to be followed during mining activities. Other health and safety considerations include the protection of surface and groundwater from leaks or spills of hazardous or toxic materials, the stability of operational components such as the waste rock dump and heap leach facility, and the protection of wildlife from exposure to cyanide. In addition, MSHA requires rigid employee training on the handling of reagents and process solutions and includes provisions for monitoring worker exposure levels.

SCOPING AND PUBLIC PARTICIPATION

The environmental review procedures that guide the EIS process are prescribed by NEPA, CEQ regulations, and BLM regulations and policies. All applicable laws and regulations guiding the EIS require both interagency and public involvement. This "scoping" process is used to identify the range of actions, alternatives, mitigation measures, and significant effects to be analyzed in depth within the EIS process. While scoping focuses the EIS process on significant effects, it also serves to eliminate from detailed study those issues found not to be of major consequence.

Public Participation and Scoping Plan

A Public Participation and Scoping Plan was developed and implemented early in the EIS process. Overall goals of public participation and scoping include:

- *to inform the public of the EIS decision-making/problem solving process;*
- *to identify the potentially affected public;*
- *to identify and clarify key issues, concerns, and opportunities important to the public;*
- *to provide information to the public and BLM's administrative staffs, and make an effort to insure that the information is understood by all parties;*
- *to provide a method to receive and understand input from the public; and*
- *to inform the involved public as to how their input was used by BLM and other involved agencies.*

A Notice of Intent (NOI) to prepare an EIS for the Oro Cruz operation was published in the Federal Register on Friday, June 5, 1992 (Federal Register, Vol. 57, No. 109). The NOI also announced the dates, times, and places for public scoping meetings which were held in El Centro, California and Yuma, Arizona. A Scoping Document was developed to summarize the proposed action, BLM roles and

responsibilities, the EIS process, and project schedule. The Scoping Document was made available to all persons who attended public meetings or who otherwise requested a copy.

The public scoping meetings were held on June 30, 1992 in El Centro and on July 1, 1992 in Yuma. No one attended the meeting in El Centro; 12 persons attended the meeting in Yuma. The NOI also served as notice to solicit written comments on the Oro Cruz operation; the written comment period was from June 5 through July 17, 1992. Two comment letters, from the U.S. Bureau of Mines and the U.S. Environmental Protection Agency, were received by BLM during the written comment period. All comments received during the scoping period are addressed within this EIS.

Significant Environmental Issues

Based on BLM's previous experience with the operating components of the existing American Girl Project, comments from the public, and comments from other governmental agencies, a list of potentially significant environmental issues was developed. These issues include:

- <u>*Wildlife*</u> *-- Nine Federal or state of California threatened, endangered, and candidate species are present, or potentially present within the project area. Issues include effects on these and other wildlife species from cumulative American Girl Project mining and processing operations, disturbances to wildlife habitat, and the effects from use of cyanide during processing.*

- <u>*Cultural Resources*</u> *-- From the mid-1880s to about 1920, the project area was the site of an important, though relatively unknown, mining boom. Cultural resources found within the historic communities known as Hedges/Tumco need to be identified and protected.*

- <u>*Visual Resources*</u> *-- While the location of the American Girl Project is within a relatively sparsely populated, remote area, historic mining scars and current project development can be seen from Interstate 8 and County Highway S34 (Ogilby Road).*

- <u>*Recreational Use/Public Safety*</u> *-- The major recreational uses within the study area are rockhounding, hiking, and visitation to the historic Hedges/Tumco communities. Effects on these recreational uses and public safety (e.g., access to cyanide, mining equipment, and other hazards) are potentially significant issues.*

- <u>*Cyanide Management*</u> *-- Sodium cyanide is a hazardous substance which is toxic to humans and wildlife. Issues include drip versus impact cyanide solution sprinklers, pond/ditch enclosures and wildlife mortality.*

- <u>*Reclamation*</u> *-- When mining and processing of ore ceases, the facilities and changes caused by mining must be decommissioned and reclaimed. Issues include the adequacy of proposed reclamation procedures, the practicality and consequences of backfilling mining pits, and reclamation bonding to insure adequate funds for future reclamation.*

Development of Alternatives

From the list of potentially significant environmental issues, BLM guidelines, and the Oro Cruz POO, alternatives to the proposed action have been developed. These alternatives are discussed in detail within Chapter 2 of this EIS. Alternatives were evaluated in terms of technical and economic feasibility and reasonableness. Many alternatives were eliminated from detailed analysis within the EIS for reasons relating to engineering design, economic feasibility, and adverse environmental impact. Mitigation measures to lessen adverse impacts can be developed which condition BLM's approval of the proposed action.

CHAPTER 2

PROPOSED ACTION, ALTERNATIVES, AND ACTIVITIES AFFECTING THE CUMULATIVE ENVIRONMENT

This chapter describes the proposed action for the development of the Oro Cruz operation of the American Girl Project. Reasonable alternatives to the proposed action, including the no action alternative, are also described. Additionally, existing and reasonably foreseeable future activities affecting the cumulative environment are also described and discussed.

DEVELOPMENT OF ALTERNATIVES

In an EIS, the lead agency is required to evaluate the environmental effects of the proposed action and reasonable alternatives to the proposed action. The Draft EIS must consider the proposed action and the no action alternative:

- *Proposed action -- AGMJV would develop, operate, monitor, and reclaim the Oro Cruz operation as proposed in the POO. BLM would grant the required approval for operation.*

- *No action -- Under this alternative, AGMJV would not develop the Oro Cruz operation. BLM would not grant the required approval for the operation. The no action alternative provides a baseline for estimating the effects of other alternatives. In this EIS, the no action alternative is evaluated as Alternative 1.*

Other alternatives consist of reasonable modifications to various elements of the proposal. These alternatives fall into two main categories -- those that modify the location of facilities and those that modify the methods and procedures to be employed in the operation. Comments from the public and other agencies, along with BLM experience and policies form the basis for consideration of alternatives to the proposed action. Alternatives considered for detailed study within this EIS have been developed to respond to potentially significant project impacts, and are related to the significant environmental issues discussed in Chapter 1. Some alternatives to the proposed action have been eliminated from detailed study for reasons relating to engineering design, economic feasibility, and adverse environmental impact.

Table 2 provides a summary of alternatives considered for detailed study. Subsequent sections of this chapter describe the alternatives to be fully analyzed within this EIS and the rationale for elimination of some alternatives from detailed study.

THE ORO CRUZ OPERATION AS PROPOSED BY AGMJV

Figure 2 shows the historic and projected schedule for the Padre Madre and American Girl Canyon

TABLE 2

APPLICANT'S PROPOSAL AND SUMMARY OF POTENTIAL ALTERNATIVES

Operational Component	Applicant's Proposal	Alternatives to Proposed POO
Mining Operations	A combination of surface and underground mining is proposed. Rates of mining are based on equipment availability and processing thresholds.	1) Underground mine only* 2) Surface mine only* 3) Change in rate of mining*
Processing Operations	Due to wide variation in ore grade, both milling and heap leaching is proposed to obtain economical gold recovery. Rates of processing are based on crushing and milling design capacity, typical leach cycle times, and equipment availability.	1) Mill operations only (using existing mill at American Girl Canyon)* 2) Heap leach operations only* 3) Change in rate of processing* 4) Ore processing offsite*
Facility and Component Location	Two economic surface mining pits have been identified and are proposed for mining. One economic underground mining target beneath the Cross pit is also proposed for mining. To avoid environmental impacts and project costs, AGMJV proposes to use existing processing facilities at American Girl Canyon, necessitating a haul route between Oro Cruz and American Girl Canyon. The proposed waste rock dump site is based on avoidance of impacts to cultural, wildlife, mineral and visual resources.	1) Different location of pits and underground components* 2) All project facilities to be located at Oro Cruz (Oro Cruz to be developed as a stand-alone facility without the use of mill and heap leach at American Girl Canyon)* 3) Different waste rock dump location* 4) Haul route to American Girl Canyon mill using Ogilby Road*
Waste Rock Management	The applicant proposes a partial backfilling scenario in which the Queen pit would be backfilled. The Cross pit is not proposed for backfilling, requiring surface disposal of waste rock.	1) Complete backfilling of waste rock.
Heap Leach Design	The applicant proposes to continue processing at the heap leach at American Girl Canyon using existing techniques.	1) Change in design of heap leach facility.*
Electrical Power Supply	AGMJV proposes to use the existing facility at American Girl Canyon to generate electricity with a powerline constructed to Oro Cruz along the haul road.	1) Construction of substation and power lines to site*
Water Source and Supply	Use of water in flooded underground workings (obtained from a dewatering program) and groundwater from a well southwest of American Girl Canyon (via a waterline) is proposed for use at Oro Cruz.	1) Truck or pipe water from another source*
Cyanide Management	AGMJV proposes to continue existing cyanide management procedures at American Girl Canyon including application by impact sprinkler and use of netting to cover cyanide solution.	1) Drip application of cyanide solution 2) Floating cover over ponds containing cyanide solution

* Eliminated from detailed NEPA analysis

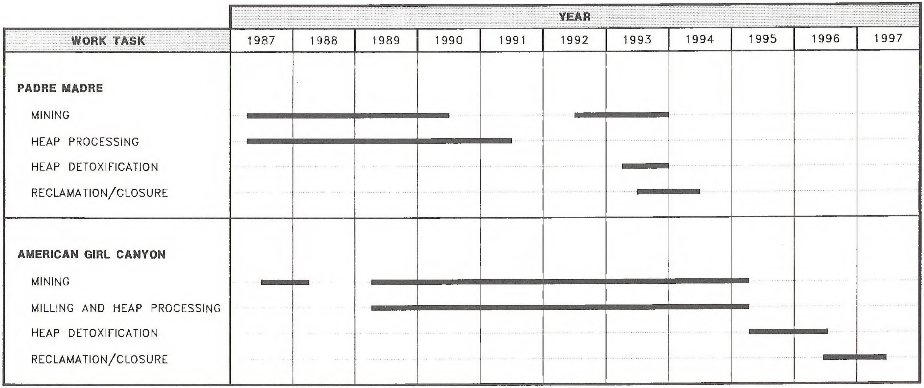


FIGURE 2

AMERICAN GIRL PROJECT SCHEDULE
(WITHOUT ORO CRUZ)

operations (without Oro Cruz). Table 3 shows the historic mined quantities from these existing operations by year. The Padre Madre test operation in 1987 involved the mining and heap leaching of 200,000 tons of ore and 400,000 tons of waste rock; the full scale development was permitted for 3.5 million tons of ore and 12.5 million tons of waste rock. The American Girl Canyon operation was permitted for 8.5 million tons of ore and 17 million tons of waste rock. Ore processing at the Padre Madre operation was limited to heap leaching, while American Girl Canyon operation involves both heap leaching and the milling of sulfidic ores and the higher grade oxidized ore from both the Padre Madre and American Girl operations. Approximately 5 percent of the total ore from both operations is processed through the American Girl Canyon mill. The cumulative total disturbance for both existing operations is 618 acres.

Figure 3 shows the location of the proposed Oro Cruz operation in relation to the Padre Madre and American Girl Canyon operations.[2] Figures 4 through 7 show the proposed Oro Cruz, existing American Girl Canyon, and existing Padre Madre operation layouts. As shown in Figure 8, AGMJV proposes to begin Oro Cruz operations in summer of 1994 with haul road construction and surface operations. The proposed operation would extend existing American Girl Project operations an additional two years beyond currently permitted operations at Padre Madre and American Girl Canyon. Reclamation/ closure activities associated with Oro Cruz are proposed by the applicant to be completed by mid- 1999.

The Oro Cruz operational concept is illustrated in Figure 9. Peak employment associated with the operation would be 174 persons. Mining operations would include two shifts, with activities extending into night-time hours. The existing mill would continue to operate 24 hours a day, 365 days a year.

As proposed, an estimated 101 acres in the Oro Cruz area would be directly affected by surface mining, waste dumps and haul roads (see Table 4). An additional 50 acres would be disturbed for the haul road between Oro Cruz and the American Girl Canyon operational area and 40 acres would be used as a source of aggregate for backfilling of underground mine workings. A significant portion of the proposed mining disturbance would occur in areas previously affected by historic mining and exploration activities.

The following sections describe the various elements of the Oro Cruz operation as proposed by AGMJV. A summary of the environmental protection measures proposed by AGMJV is also provided in this Chapter of the EIS.

[2] The boxes labeled 1 through 4 on Figure 3 indicate the boundaries of more detailed maps showing the layouts of each operation. Box 1 includes the proposed Oro Cruz operation area (e.g. surface mining pits and waste rock dumps) and the northern portion of the proposed haul road to American Girl Canyon; box 2 includes a small area of the American Girl Canyon operation and the middle portion of the proposed Oro Cruz/American Girl Canyon haul road; box 3 includes the major facilities within American Girl Canyon and the eastern end of the proposed Oro Cruz/American Girl Canyon haul road; box 4 includes the Padre Madre operational area. The more detailed maps represented by box 1 through 4 are used throughout the EIS.

TABLE 3

HISTORIC PRODUCTION QUANTITIES
FROM PADRE MADRE and AMERICAN GIRL CANYON OPERATIONS

Year	Padre Madre (Surface Mining)		American Girl Canyon (Surface Mining)		American Girl Canyon (Underground Mining)	
	Ore Tons	Waste Tons	Ore Tons	Waste Tons	Ore Tons	Waste Tons
1987	445,000	1,025,000				
1988	755,000	2,684,000			14,700	45,300
1989	861,000	2,641,000	195,000	1,702,000	0	0
1990	116,000	74,000	1,171,000	3,265,000	83,400	14,300
1991	0	0	1,362,000	2,580,000	181,500	14,300
1992	187,000	616,000	806,000	1,114,000	189,000	28,000

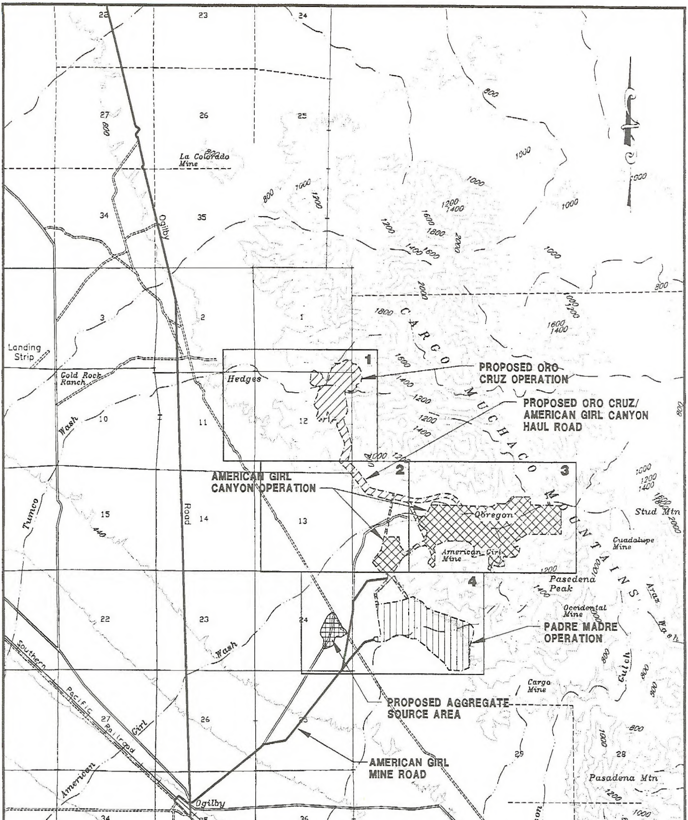


FIGURE 3

AMERICAN GIRL PROJECT
SITE LAYOUT MAP

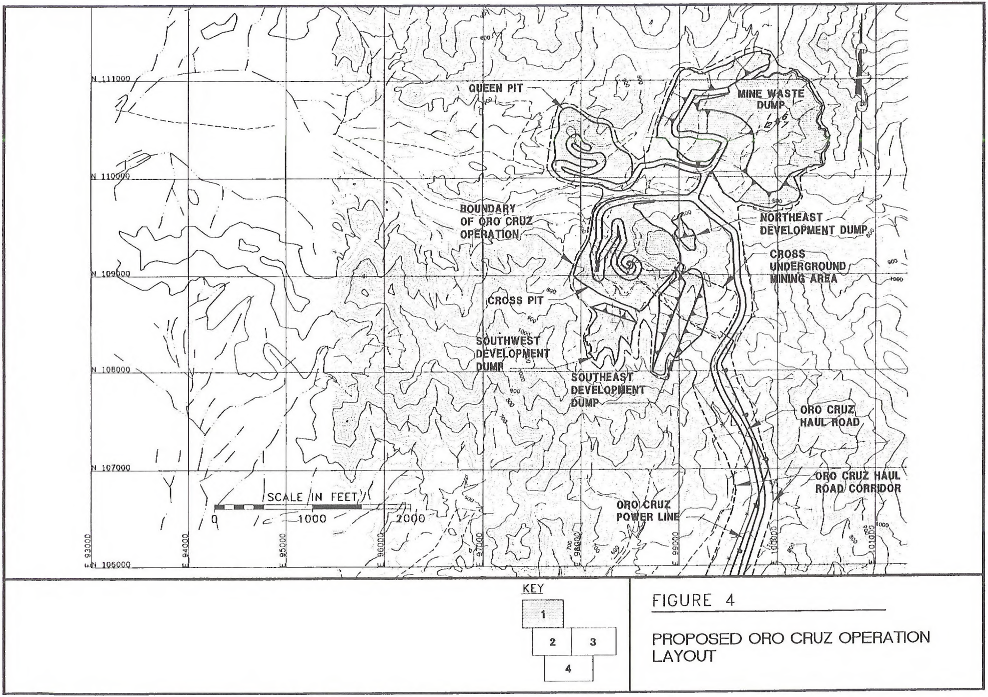


FIGURE 4

PROPOSED ORO CRUZ OPERATION LAYOUT

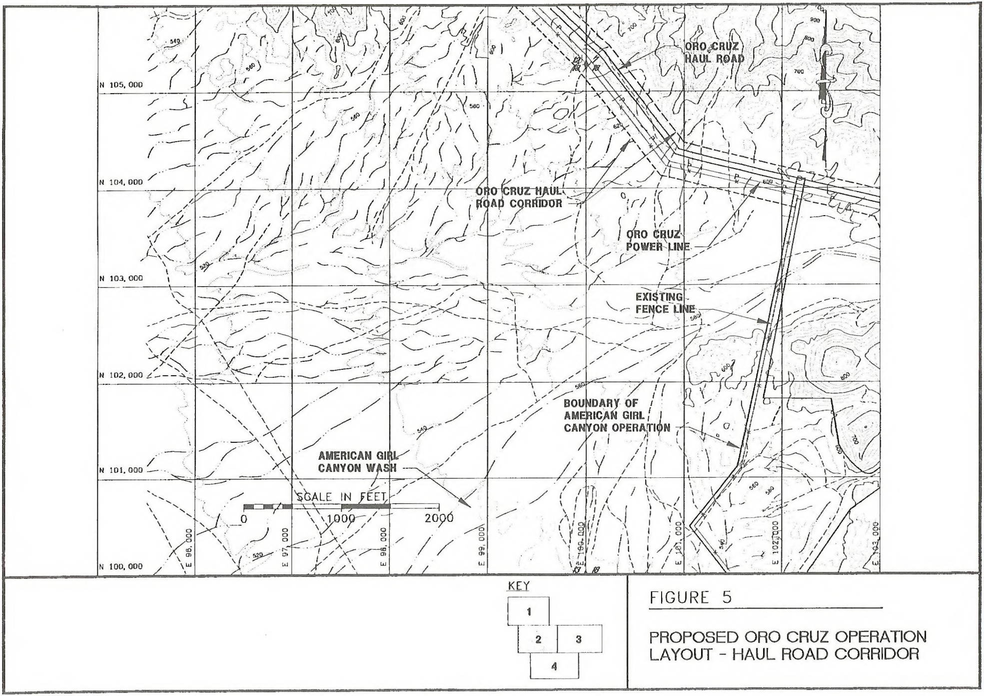
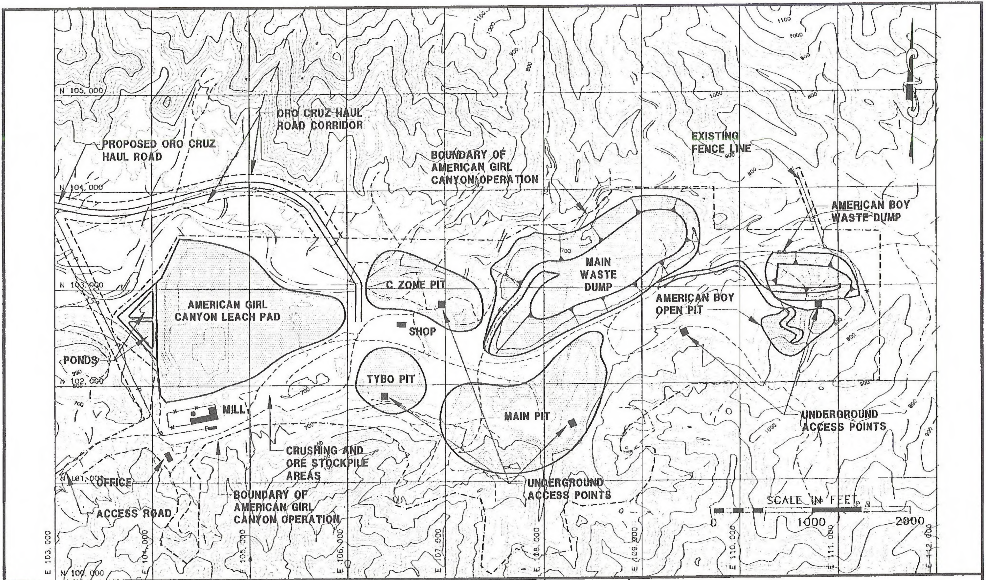


FIGURE 5

PROPOSED ORO CRUZ OPERATION LAYOUT - HAUL ROAD CORRIDOR



KEY

1	
2	3
4	

FIGURE 6

AMERICAN GIRL CANYON OPERATION LAYOUT INCLUDING LOCATION OF PROPOSED HAUL ROAD

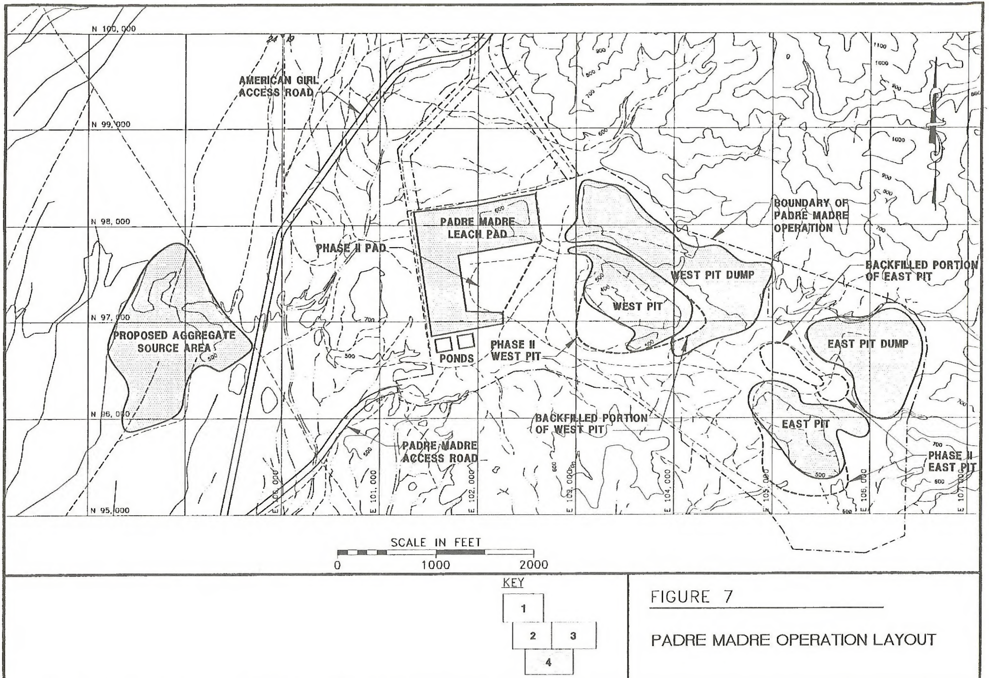


FIGURE 7

PADRE MADRE OPERATION LAYOUT

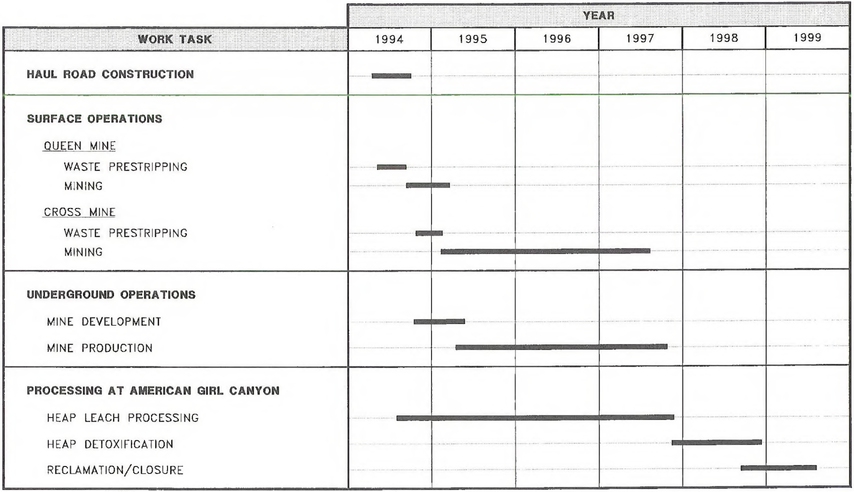


FIGURE 8

PROPOSED ORO CRUZ PROJECT SCHEDULE

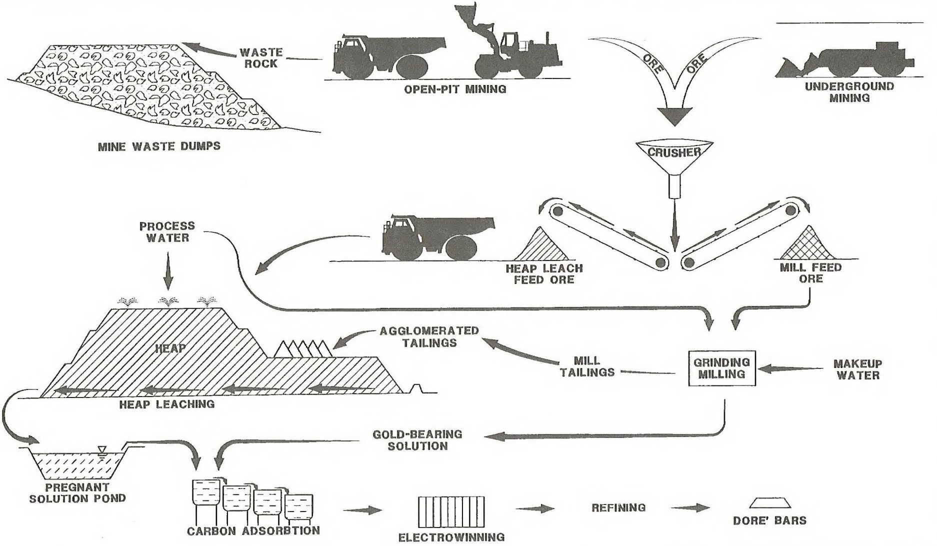


FIGURE 9

SCHEMATIC DIAGRAM
OF PROCESS

TABLE 4

PROJECTED DISTURBED AREAS FOR ORO CRUZ OPERATION

Component	Disturbed Area (Acres)
Cross Pit Queen Pit	25 15
Development Dumps Mine Waste Dump Haul Roads to Dumps	13 43 5
Total area of components listed above	**101**
Aggregate Pit Oro Cruz Haul Road Corridor	40 50
Total Disturbance	**191**

Summary of Proposed Surface Mining Operations

During the estimated two years of proposed open-pit mining, AGMJV would mine about 2.5 million tons of ore and 8.5 million tons of waste rock. The annual waste and ore mining rates would vary from year to year; however, during the most active periods, the maximum yearly and daily mining rates would be:

Waste--3.5 million tons per year
22,500 tons per day
Ore--1.2 million tons per year
5,500 tons per day

As proposed, surface mining at Oro Cruz would begin in the Queen pit and would entail mining 500,000 tons of ore and 1,000,000 tons of waste rock. Present geologic information indicates that economic ore does not continue at depth outside the Queen pit limits. Therefore, following the completion of mining at the Queen, AGMJV proposes to backfill the pit with waste rock from the lower levels of the Cross pit. The Queen pit would accommodate approximately 1.1 million tons of the Cross waste rock. Waste rock would fill the topographic depression to a level 20 to 40 feet above the valley floor. Due to the steep pre-mining relief, it is not possible to fully recreate the original topography by backfilling and a mining highwall would remain. Backfilling would be accomplished by end dumping from the Queen pit perimeter.

The Cross pit contains approximately 2 million tons of ore and 7.5 million tons of waste rock. AGMJV proposes to keep the Cross pit open after surface mining is completed. This proposal is based on the applicant's desire to retain access to additional ore reserves which are uneconomic to mine with current gold prices. If metal prices were to increase in the future, however, this lower grade mineralization could become economic, requiring an expansion of the Cross pit to access these reserves.

AGMJV proposes that the majority of mined waste rock be disposed of in a dump located northeast of the Cross pit in the Tumco valley. In addition, waste rock would be disposed of in the Queen pit and in three small development dumps adjacent to the Cross pit.

Equipment Requirements. Table 5 provides a list of equipment required for open pit mining at Oro Cruz. The equipment is already in use at American Girl Canyon and would be transferred by AGMJV to the Oro Cruz operation as required. As the existing truck fleet is replaced, 85 ton trucks may be purchased for improved operational efficiency.

TABLE 5

ORO CRUZ OPERATION SURFACE MINING EQUIPMENT

Description
DRESSER HAULPAK - 55 Ton (4)
TEREX 33-07 HAUL TRUCK 40 Ton
DRESSER 515B LOADER
CAT 992 LOADER
TEREX 90C LOADER (2)
CAT D8L DOZER (2)
LIEBHERR DOZER
DRILLTECH D40KXL DRILL
CAT 613 WATER WAGON
HIAB CRANE
CAT 14G GRADER
CASE 580K BACKHOE
AIRTRACK DRILL
GMC LUBE TRUCK
GMC WATER TRUCK
MECHANIC SERVICE TRUCK
FORKLIFT
PICKUPS (8)
CREW VAN
PORTABLE LIGHT PLANT

Pit Configurations. The ultimate size and shape of pits is principally defined by the geometry of the mineralized zone, economics, geological/ geotechnical characteristics of the pit areas, equipment limitations and safety. As part of the exploration/development program of the proposed Oro Cruz operation, a detailed geotechnical study was conducted by AGMJV. The program consisted of:

- *Detailed surface mapping of select locations in the proposed pit area*
- *Geotechnical logging of diamond drill holes*
- *Drilling of several oriented core holes*
- *Laboratory testing of rock samples*

Data collected during the program documented the distribution and frequency of naturally occurring fractures in the rock, the overall rock strength and the resistance of the rock to failure. These data were incorporated with AGMJV operational experience gained at American Girl and Padre Madre to calculate proposed bench heights and widths and the ultimate pit wall slopes of Oro Cruz pit design.

Ultimate pit wall slopes are designed by AGMJV at 44° to 49°, with variations dependent on geotechnical characteristics of different sectors of the pit. Ultimate bench height would be 40 feet, with bench high walls separated by 25 to 30-foot wide catch benches which would act as a barrier to falling rock. Scaling of benches to dislodge loose rock would be a regular operational procedure. Haulage ramps within the pit are designed by AGMJV at grades of 10 percent and widths of 60 feet in order to meet operational requirements. The ramps would be bermed in accordance with Mine Safety and Health

Administration (MSHA) specifications. Figure 10 is a conceptional cross section indicating the basic proposed details of slope and bench design to be used at Oro Cruz.

As is the case with the open pits in the American Girl Canyon operation, a slope monitoring program would be conducted by AGMJV as mining progresses to confirm assumptions made in the initial pit design. Structural mapping, lithological interpretation, and slope stability monitoring and analysis would be basic elements of the program. The project proponent proposes to make minor modifications in pit design if conditions warrant.

Haul Roads. As proposed, the Oro Cruz operation would require haul roads for the movement of ore and waste rock within the open pit/waste dump areas. In addition, ore would be transported by truck to the existing crusher and processing facilities in the American Girl Canyon. Haul roads would be designed with a 60 foot wide running surface to accommodate the possibility of 85-ton capacity trucks. The overall width of the roads would be at least 80 feet to allow for safety berms to meet MSHA requirements. Roads to be used for access only would be 30 feet wide or less to keep construction related disturbance to a minimum. Maximum haul road grades would be 10 percent. Internal pit ramps would be constructed by AGMJV using material that must be removed as part of future mining, or in the low cut walls occurring on the north walls of the pits. During operations, haul roads would be maintained with a rubber tired motor grader. Dust would be minimized by sprinkling with water or with an approved chemical binder.

Present access to Oro Cruz is by an unimproved dirt road from Ogilby Road, about one mile west of the project area. Once a road is completed from American Girl Canyon, access to Oro Cruz from Ogilby Road would no longer be required, except possibly in emergencies. Consequently, AGMJV is not proposing to upgrade the existing dirt road to Oro Cruz from Ogilby Road.

Initial access to the Oro Cruz operational area is proposed to occur via a pioneered road constructed from American Girl Canyon to the Oro Cruz operational area. The pioneered road would be built along the surveyed route of the ultimate Oro Cruz - American Girl Canyon haul road. It would be constructed at a width sufficient for one way access by the wide haulage vehicles, yet wide enough to provide safety berms as required by MSHA. The purpose of the road is for equipment access to the Oro Cruz area; it would not be used for ore haulage. Once mining is underway at Oro Cruz, the pioneer road is proposed to be upgraded to full width to allow for two-way haulage traffic. Since both the initial access route and the ultimate haul road would be constructed along the same corridor, providing initial access to the property would result in no additional surface disturbance above that required for ore haulage.

The haul road from the proposed Oro Cruz operation to the American Girl processing facility would be approximately 2.5 miles in length with an overall road width of 80 feet. To minimize disturbance, it has been designed along the shortest practical route, requiring the least amount of cut and fill. Geologic data gathered by AGMJV along the haul road corridor also indicate a low

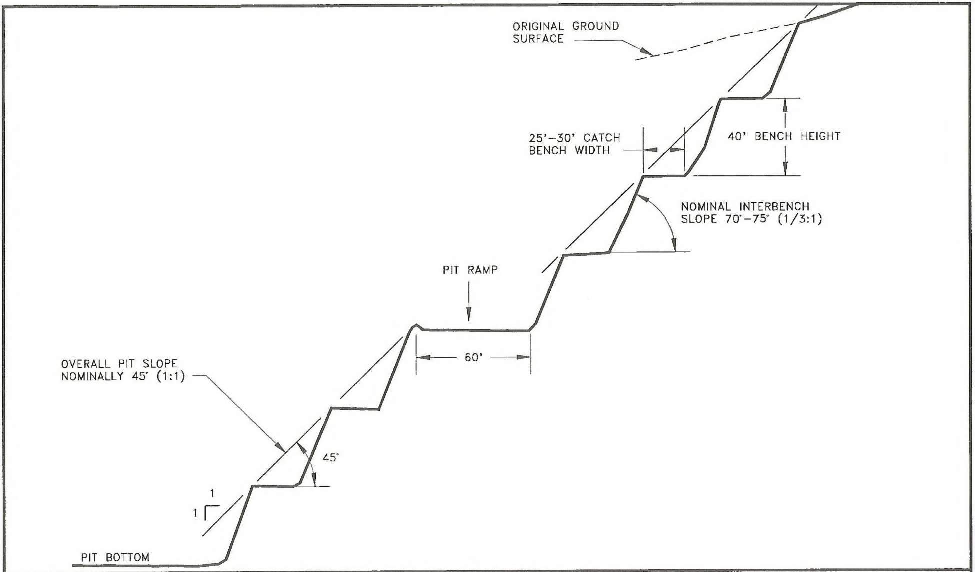


FIGURE 10

TYPICAL CROSS-SECTION OF PIT
WALL, CROSS AND QUEEN PITS

probability for economic mineralization along the route.

The ultimate width of the surface disturbance (dependent on local topography and the attendant cut and fill requirements) is estimated at 120 to 150 feet. The road would be constructed by AGMJV through use of bulldozers and, as required, drilling and blasting. Construction would begin at the northern end of the proposed road to allow use of available fill materials. The higher relief areas, requiring the greatest amounts of cut and fill, occur along the northern-most one mile of the haul road, nearest the proposed Oro Cruz operation area. In this area, the haul road initially borders the high relief areas immediately east of the Cross pit, requiring excavation of road cuts locally in excess of 30 feet. It later passes over a major saddle south of the Cross pit, requiring significant amounts of fill in order to maintain the desired grade. Design work by AGMJV on the haul road indicates that approximately 73,000 tons of fill material would be required in this northern area. Waste rock from the initial mining area is proposed to be used for this fill. The southern-most 1.5 miles of the haul road would be over areas of relatively flat topography and underlain by alluvial sediments, requiring a minimum of cut and fill.

As part of the haul road construction in the Oro Cruz operation area, a diversion channel is proposed by AGMJV to divert Tumco wash immediately north of the Cross pit up to 100 feet north of its present channel. The diversion channel would be approximately 1000 feet long and would be excavated by bulldozing the surficial gravels. The diversion is proposed to protect the haul road from erosion during episodes of flooding and to prevent storm waters from flowing into the Cross pit.

As proposed, haul roads would be required in the immediate Oro Cruz operation area to interconnect the mine areas with the waste dumps and the Oro Cruz haul road. The roads would be constructed with 60-foot running widths to accommodate two-way haulage traffic. Because the roads are located over areas of surficial gravels, construction would be by bulldozer and would involve a minimum of cut and fill.

In addition to the major waste haul roads, several temporary haul roads are proposed by AGMJV to interconnect the higher level areas of pre-stripping in the Cross pit to nearby development waste dumps. These haul roads are designed by AGMJV for one-way traffic, with overall widths of approximately 40 feet. They would be temporary in nature and would be abandoned when the pre-stripping has been completed. In order to minimize disturbance, these temporary roads are proposed to be constructed by widening and upgrading existing exploration drill roads in the area. Total proposed disturbance associated with major and temporary haul roads in the Oro Cruz area would be approximately 5 acres.

Mining (Drilling, Blasting, Loading, Hauling, Crushing). Ore and waste are proposed to be mined by typical truck-loader, open-pit methods involving drilling, blasting, loading and trucking. Drilling of blastholes would be accomplished using either rotary or percussion blasthole drills. Dust during drilling would be controlled by AGMJV through a combination of water sprays and a dust collection system mounted to the drill. The blasthole configuration would be optimized to maximize fracturing of rock with the minimum required drill holes. ANFO (Ammonium Nitrate-Fuel Oil) blasting agents initiated with cap sensitive primers would be

used by AGMJV for production blasting. Blasting would only be carried out during daylight hours and under strict safety procedures. Explosives would be delivered by licensed haulers and stored on site in approved storage facilities.

As proposed by AGMJV, ammonium nitrate for the open-pit operation would be supplied from a bulk storage facility located immediately east of the southern end of the proposed waste rock dump. A bulk explosives truck would be used to mix ammonium nitrate and fuel oil and load drill holes at the blast site. Blasting caps and explosives for the underground mining operation would also be stored on the eastern side of the proposed Oro Cruz operation.

Ore grade control would be accomplished by sampling cuttings during blasthole drilling. Cuttings would be split and assayed with assay information used to delineate ore-waste boundaries. The proposed open-pit mining schedule involves two 10-hour shifts per day, operating five or six days per week.

Heap leaching is proposed to be the primary form of processing for the Oro Cruz ore. The method of crushing, stacking, leaching and recovery would be the same as that used for the American Girl Canyon ore. Ore selected to be processed by heap leaching would be crushed to approximately 3/8-inch size, treated with lime to control pH and conveyed to the existing American Girl Canyon heap and end dumped. The higher grade ore would be crushed to approximately 3/8 inch size, treated with lime for pH control and conveyed to the existing mill at American Girl Canyon for processing, (see Heap Leach Processing and Milling sections later in this Chapter).

Waste Rock Dumps. Waste rock from the Cross and Queen pits, and a minor amount of development rock from the Cross underground area, is proposed by AGMJV to be disposed of in selected areas within the Oro Cruz operational area. The rock types, structure, and mineralization in the Oro Cruz area is similar to that of the American Girl Canyon area. Waste rock from the American Girl Canyon operation is disposed of as a Group C (inert) waste, based on geochemical characteristics outlined by the California Department of Health Services and the WQCB.

Geochemical tests were conducted by AGMJV on Oro Cruz drill hole samples representing the anticipated waste rock from open pit mining in the Cross and Queen pits and Cross underground mining. The test results are summarized in WWL (1992a). Testing included acid generation potential testing, California WET leach testing and EPA method 1312 leach testing. Test results on these samples showed very low detectable sulfur, a very high acid neutralization potential and no leaching of metals or other constituents of environmental concern. The California WET tests showed leachate quality indicative of a Class C (inert) waste. Based on the results of these tests, AGMJV proposes to dispose of Oro Cruz waste as a Group C waste through methods similar to American Girl Canyon operations.

As proposed, waste rock would be loaded and hauled the shortest possible distance to the active portion of a waste dump adjacent to the mining area. Waste dumps would be developed by haul trucks end dumping waste over the active dump face. Based on operational experience by AGMJV at the American Girl Canyon and Padre Madre operations, the slope of the Oro Cruz waste rock dump face would be at an

angle of repose of approximately 33 degrees. The dump is proposed to be developed on 40 foot lifts, separated by 20 foot catch benches. This would result in overall 2:1 dump slope (about 27 degrees). The top of the dumps would be sloped and bermed to control drainage. Figure 11 is a cross section view illustrating the basic elements of the dump design as proposed by AGMJV.

In addition to the main dump site, three development dumps are proposed by AGMJV in the immediate vicinity of the Cross Pit. These dumps would be active only during the initial stage of mining and are located in areas which have received significant disturbance from past mining activities. Access to these dumps would be by existing drill roads, upgraded to the minimum width required for the heavy equipment access. The three development dumps would cover about 13 acres and would hold about one million tons of waste rock, or 12% of the total waste rock tonnage.

The establishment of development dumps is proposed by AGMJV because it is the only practical way to dispose of waste rock from the highest level of the Cross Pit development, where working benches would be small and have limited accessibility. Otherwise, AGMJV would need to construct a haul road from the higher levels of the mine development to the valley floor, an elevation difference of about 200 feet, for disposal in the main waste dump. Since currently existing drill roads are often built at grades in excess of 10%, drill roads would not be adequate for waste haulage and a new haul road would have to be constructed at the proper grade. This would require significant disturbance in areas of the Oro Cruz project not presently affected by exploration activities. Due to topography, road cuts in excess of 20 feet would be common and drilling and blasting would be required for construction. To provide continual access to mining areas, such a waste haulage route would also have to be continuously rerouted as the mining progresses to lower elevations above the valley floor. This is in contrast to mining below the valley floor in the Cross Pit, where deeper levels are accessed by progressively extending the main haulage ramp.

Beyond these considerations, the largest of the development dumps, the southeast dump, is believed by AGMJV to be essential from an operational standpoint. The dump is located in a northwest tending valley which can experience torrential flows during heavy rainfalls. The proposed dump location would allow diversion of these flows and prevent flooding of the Cross Pit in the event of major storms. The underground portal and all surface facilities associated with the underground development are also proposed to be located on a portion of this dump to prevent flooding.

Surface Water and Ground Water Management. All drainages in the Oro Cruz area are intermittent and contain water only during and immediately following major rainstorms. Diversion ditches are proposed to be used to intercept and control runoff water entering dump and pit areas from upstream sources. Diversion structures would be sized to accommodate peak runoff from a 100-year storm. It is anticipated by AGMJV that natural internal drainage of the waste rock dumps ultimately would take place as a result of material segregation occurring during end dumping. Original exploration holes drilled in the open-pit mining areas were confirmed by AGMJV to be dry below planned

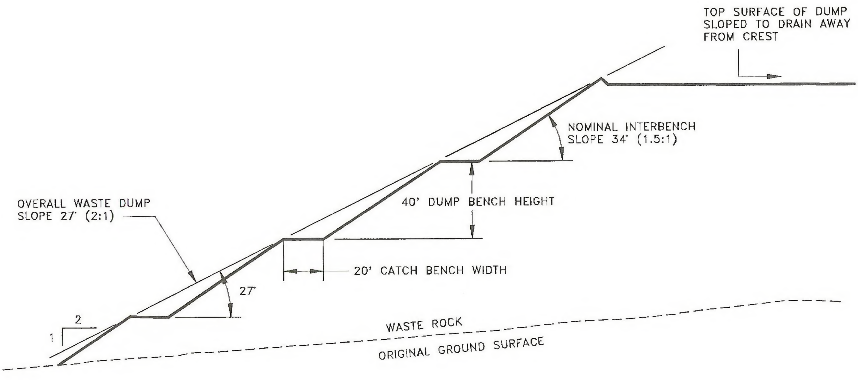


FIGURE 11

TYPICAL CROSS-SECTION OF
WASTE DUMP ROCK SLOPE

mining elevations. Consequently, AGMJV has designed facilities with the assumption that no groundwater flow into open-pit mining areas would occur.

During exploration, AGMJV encountered some groundwater in historic underground workings in the deeper portions of the ore zone. The water is believed by the applicant to be the result of surface runoff which entered the workings through open portals and shafts and has accumulated since the cessation of mining in the early 1900s. No groundwater of significant quantity is anticipated by AGMJV in future underground workings.

Lighting. With current plans, lighting would be necessary at several of the project facilities in order to extend operating hours beyond daylight, as well as for reasons of security and safety. Four portable light plants (metal halide, four lights per plant, 88,000 lumens per light) are proposed for the surface mining operation to light the active ore and waste removal mining areas and the active waste rock dump areas. These lights would be hooded, directional lights.

Surface Facilities. The applicant proposes to continue use of the existing administration and maintenance facilities in American Girl Canyon. No major facilities would be developed at Oro Cruz to support surface operations. Likewise, fuel storage facilities for surface mining are proposed to remain at the American Girl Canyon facilities, with fuel and lubricants dispensed from a lube/service truck. Powder magazines would be situated on the lower levels of the Oro Cruz main waste dump in bermed areas. A water truck filling station is proposed to be built adjacent to the haul road southeast of the Cross pit. The station would consist of a 50,000 gallon tank and a standpipe under which the water wagon would load. AGMJV also proposes to move a small, 12 foot by 40 foot lunchroom/first aid trailer from the American Girl Canyon mine site to the Oro Cruz site.

Summary of Proposed Underground Activities

During the proposed three year life of the underground mining operation, it is anticipated by AGMJV that 65,000 tons of waste rock would be mined during development stages and 500,000 tons of ore would be mined during production stages. During this time period, AGMJV proposes underground ore mining rates of approximately 250,000 tons of ore per year, or 1,000 tons per day over a five day per week operating schedule.

As proposed, the underground operation would be, for the most part, separate from the surface mining operations, although the two would be linked in terms of ore processing. Because most of the ore from the underground ore bodies is of a higher grade than is much of the ore in the surface deposits, most of the underground ore is proposed to be processed in the mill facility rather than in the heap leach facility. Conversely, most of the ore mined from surface deposits, due to its lower grade, would be processed in the heap leach. However, ultimate determination of processing treatment would be based on assays of the mined ore by AGMJV, and would depend solely on grade and not on ore body position. Development of the underground ore bodies is proposed to begin in 1994 to allow for a continuous feed of high-grade ore to the American Girl Canyon mill after the American Girl Canyon ore deposits are depleted. The

underground portal and all facilities would be located near the main haul road, immediately southeast of the Cross pit.

Equipment Requirements. As is the case with the Oro Cruz surface mining operations, equipment proposed for use in the underground mine would be transferred from the American Girl Canyon underground operation. The equipment would be transferred to Oro Cruz over a period of time to allow for full underground production to begin about six months after the start of the initial underground development. An underground equipment list is included as Table 6.

Underground Ore Body Description. The high grade mineralization at the Oro Cruz property occurs as massive quartz-magnetite bodies localized along three structural zones dipping south at 20-30°. The three structural zones are subparallel and stacked over a vertical distance of 150-200 feet. The ore zones are typically narrow (up to 200 feet wide) lenticular bodies with a marked downdip elongation. Widths of the high grade ore zones vary from five feet to greater than thirty feet with grades typically greater than 0.25 oz/ton gold. The high grade zones are typically enveloped by a halo of lower grade mineralization.

The underground ore body at Oro Cruz has not been completely delineated by surface drilling. Exploration by both surface and underground drilling by AGMJV would continue and could result in an expansion of the reserves.

TABLE 6

ORO CRUZ OPERATION
UNDERGROUND MINING EQUIPMENT

Description
EIMCO 955 MINETENDER (3)
EIMCO 5 TON DUMP TRUCKS (5)
JCI 13 TON HAUL TRUCK
JCI 15 TON HAUL TRUCK
ELMAC 15 TON HAUL TRUCK
EIMCO JUMBO DRILL (2)
JCI 125M LOADER
JCI 100M LOADER
JCI 50M MINI-LOADER
JCI 250M LOADER (5)
GD JACKLEG DRILL (10)
SHOTCRETE MACHINE
COMPRESSOR - 750 cfm
MAIN VENT FAN - 300 hp
AUXILIARY FANS - 20 hp (10)
JOY SLUSHER (2)
GRADER
PICKUP TRUCKS (3)
CON-E-CO LO-PRO BATCH PLANT

Underground Mining Method. The underground mining method proposed at Oro Cruz would be quite similar to that presently employed at the American Girl Canyon underground mine wherein parallel stopes are driven on several mining horizons and later filled with a cemented backfill mix. Fundamental differences between the two ore bodies, however, would require some modifications in the mining concept.

The ore bodies associated with the underground development at American Girl Canyon are shallow dipping (19°) and typically narrow veined (5-15 feet). The economic mineralization of these ore bodies tends

to be continuous in nature. The underground mining method developed for American Girl Canyon is a rubber tired drift and fill method. In this method, stopes are mined as a series of individual drifts (or slots). Individual drifts are typically eight feet wide and are mined to the full height of the mineralized horizon. Roof support is supplied by roof bolting and; as required, chain link mesh and other support methods. Upon completion of mining a particular drift, the drift is backfilled prior to mining the immediately adjacent drifts. Ultimately, only the last drift in a series of parallel drifts will remain open. The opening will be surrounded on both sides by two or more backfilled drifts. Backfilled drifts are completely filled with cemented mix, e.g. backfill has replaced the original ore zone on a 1:1 volummetric basis. This mining method has proven successful in the American Girl Canyon and has allowed for virtual full extraction of the ore zone while keeping most of the development within the ore zone.

The Oro Cruz underground deposit differs from the American Girl Canyon deposits in that it is steeper dipping (20-40°) and consists of three parallel structural zones. The ore zone tends not to be as continuous and in some instances the ore blocks are thick vertically (20-40 feet). Although the proposed mining method would be similar to that in use at American Girl Canyon, the discontinuous nature of the ore zone, the high vertical heights and the three separate structural zones would require that much of the development mining at Oro Cruz would take place outside of the ore zone. This drift and fill method is believed by AGMJV to provide effective support and stabilization of the underground work area during mining, while allowing near total extraction of the ore zone. Rock mechanics studies by AGMJV to evaluate specific aspects of the mining method are ongoing and would continue for the life of the proposed Oro Cruz operation.

As proposed by AGMJV, about 10-15% of the total rock mined from the Oro Cruz underground would be waste, either from development drifting or internal waste in the ore zone. Most of the waste rock from the Oro Cruz underground would be disposed of on the surface, outside the portal area.

Potential Subsidence and Proposed Backfilling of the Underground Workings. In order to optimize the recovery of ore and to enhance safety within the underground operation, the majority of ore removed from the Oro Cruz underground operation is proposed to be replaced by cemented backfill material. In a manner similar to the American Girl Canyon operations, the compressive strength of the backfill used by AGMJV at Oro Cruz would be regularly monitored to ensure that it is adequate to bear the load of the overlying rock mass. If necessary, the applicant proposes to increase the backfill strength through the use of a larger portion of cement.

Ultimately, AGMJV proposes to replace approximately two-thirds of the mined volume with cemented backfill. The main underground access, the ventilation decline and the development drifts are proposed to remain open indefinitely. After installation of BLM-approved "bat gates", these openings could serve as bat habitat after underground mining has been completed.

AGMJV believes that the planned backfilling program would not result in surface subsidence caused by the Oro Cruz underground operation. A similar

program in American Girl Canyon has resulted in no measurable surface subsidence.

Backfill Aggregate Source. Specifications for backfill aggregate require that the material be well graded (exhibit a range of grain sizes), have a minimum of -200 mesh material and a low percentage of detrimental components, such as clays. Failure to meet the specifications would result in backfill of inadequate strength. To meet requirements for the American Girl Canyon underground, aggregate is presently obtained from recent gravels of the main American Girl wash.

The proposed aggregate source for Oro Cruz backfill is an abandoned borrow pit located approximately 2000 feet west of the Padre Madre leach pad, in the alluvial covered flats bounding the mountain range. The aggregate is proposed to be obtained through a material sales contract with the BLM. The existing pit covers approximately 40 acres and is the result of the extraction of near-surface gravel used to support past county road building activities. Following previous operations, it was unreclaimed and is presently virtually unvegetated. Use of this existing pit would allow the extraction of aggregate without increasing the current level of surface disturbance.

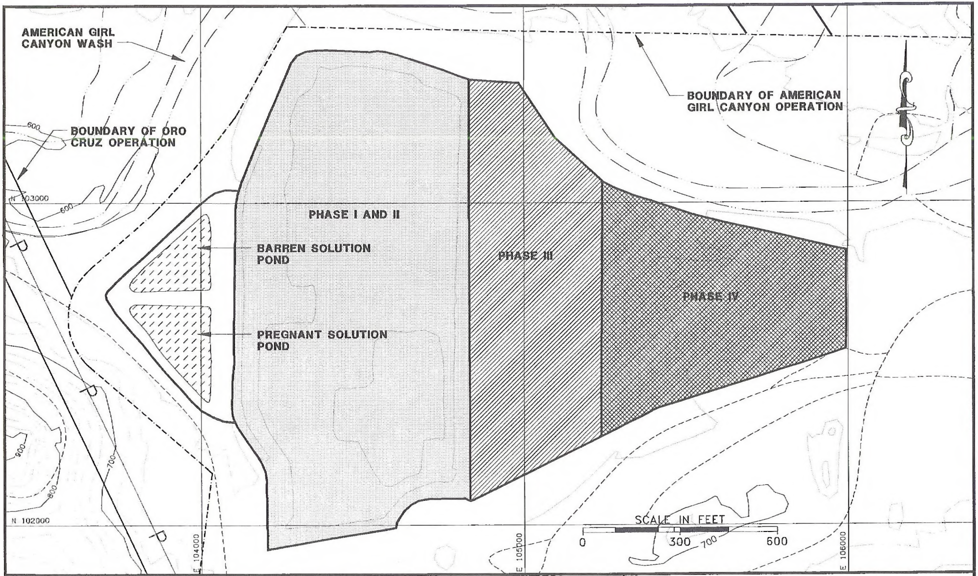
Mining a continuous bench in the disturbed area to a depth of five feet is proposed to meet the backfill requirements of the Oro Cruz underground (about 300,000 tons of aggregate). To meet quality specifications, however, mining would be selective and a mined depth of up to 20 feet could occur locally. Aggregate would be mined by front end loader and, if necessary, quality would be upgraded by screening or washing. It would be hauled to the American Girl crushing facility on existing mine roads for crushing to -3/4" prior to haulage to Oro Cruz. In order to meet the operational needs of Oro Cruz, aggregate mining, haulage and crushing is proposed to take place approximately one day a week. Following completion of aggregate mining, the area would be recontoured and reclaimed in a manner consistent with an approved reclamation plan.

Underground Facilities. The surface facilities associated with underground development would be constructed by AGMJV for portability. Most of the facilities, such as the concrete batch plant and storage buildings, are proposed to be relocated to Oro Cruz from the existing American Girl Canyon operation. A total of 2 to 3 - 12 foot x 60 foot trailers would be used for locker rooms and engineering offices. The shop facility would be a 50 foot x 50 foot x 12 foot prefab metal building on a concrete slab. All facilities would be required to comply with state and local building codes.

Heap Leach Processing Facilities

The currently permitted American Girl Canyon heap leach facility is proposed for leaching Oro Cruz ore. This would require construction of the permitted Phase IV of the leach, expanding the existing pad eastward (see Figure 12). The proposed action would require modification of the American Girl Canyon heap permit requirements from the WQCB to process Oro Cruz ore.

No new pond construction is proposed to accommodate solutions associated with Oro Cruz ore processing. To increase the emergency capacity of



PHASE I AND II (IN OPERATION)

PHASE III (IN OPERATION)

PHASE IV (ORO CRUZ OPERATION)

FIGURE 12

AMERICAN GIRL CANYON LEACH PAD LAYOUT

existing ponds, however, AGMJV proposes to surround the existing ponds with a lined containment area. Lined berms surrounding the containment area would act to effectively increase the total pond capacity.

Heap Leaching General Procedures. AGMJV proposes to continue use of current procedures at the American Girl Canyon heap leach to process Oro Cruz ore. These procedures are described below. A cross-section of the American Girl Canyon heap leach is shown in Figure 13.

Heap leaching of gold ore is a process by which a gold-dissolving solution (dilute sodium cyanide) is percolated through the ore piled onto a lined pad designed to have a very low permeability, thus providing for the containment and collection of the leachate solution. As the solution percolates, or leaches the crushed or broken ore, it dissolves gold, silver and a few trace elements from the rock. The gold bearing ("pregnant") solution drains to a collecting basin, referred to as the pregnant solution pond. Solution is removed from this pond, as needed, to be processed through a series of tanks known as the carbon adsorption process. By a complex set of processes the gold in solution is collected onto activated coconut shell carbon where it is concentrated and held prior to additional processing. The solution exits the carbon adsorption process as "barren" solution or solution that is void of gold content. The solution that is barren is again contained in a pond called the "barren" solution pond, and is then fortified with additional chemicals to ensure maximum effectiveness before it is reapplied to the ore to begin a second pass of leaching. All solution is reused. The carbon, with its retained gold content is then handled again to remove or strip the gold away from the carbon, where it is mobilized as a soluble complex in solution. At this point the solution from stripping of the carbon is co-mingled with solutions from the American Girl Canyon milling operations and the processes join or are indistinguishable. The final step is to "plate" the gold onto a host material using electrical current, wherein the metal is precipitated from the solution. This solid matter, or sludge, from electrowinning is then filtered, retorted to drive off and collect volatile mercury, (if any is present), and then fire- purified (smelted) to recover an impure form of gold and silver, known as dore'. It is this dore' that represents the final product of the mining and processing of the American Girl Project.

Both pregnant and barren solution ponds are part of an overall closed circuit, zero discharge facility and are double lined with full leakage detection systems in place and monitored several times each month and reported to the WQCB. The applicant proposes to continue this monitoring and reporting system if Oro Cruz is approved. The heap leach pad is lined and incorporates leak detection, again reported to the WQCB. The pond and pad liner system have been sized to contain process solutions and rainfall for the designed storm events and possible power failure.

All chemicals and reagents used in the processing and recovery of the precious metals are stored within the original shipping containers and organized according to reactivity and compatibility (no acids with cyanide). The reagents are stored within the mill yard, which is fenced and gated to limit access. All waste barrels are rinsed and disposed of in accordance with all local, state, federal and MSHA/CalOSHA guidelines. All used chemicals go through a

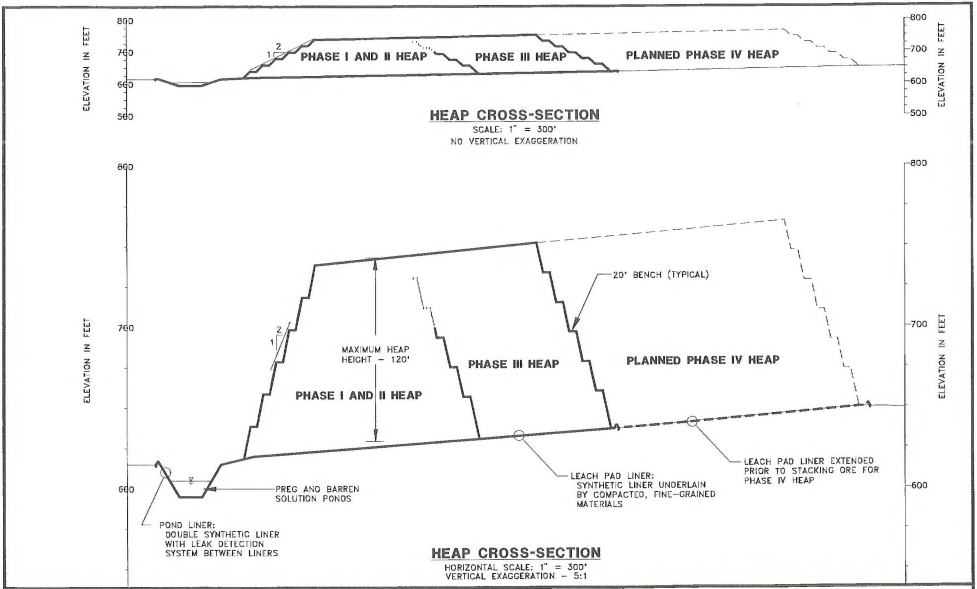


FIGURE 13

GENERALIZED CROSS-SECTION THROUGH AMERICAN GIRL CANYON HEAP

neutralization process before disposal. At the end of the project, any unused reagents would be shipped back to the supplier in their original approved containers.

Sodium cyanide is delivered in 3,000 lb. steel flow-bins owned by and returned to the supplier. Sodium hydroxide and muriatic acid are stored in 55-gallon drums. Lime is stored in a silo, and nitric acid is stored in small drums.

The following is an estimate of the chemicals proposed to be used in precious metals processing and recovery at the American Girl site in processing Oro Cruz ore:

- *sodium cyanide ($NaCN$) solid - 2 million lbs/year*
- *sodium hydroxide ($NaOH$) solid - 300,000 lbs/year*
- *muriatic acid (HCl) liquid - 300,000 lbs/year*
- *lime (CaO) solid - 8 million lbs/year*
- *nitric acid (HNO_3) liquid - 2,000 lbs/year*

Pad System. The phase IV section of the American Girl Canyon leach pad is proposed to be used for Oro Cruz ore. It would be constructed as currently permitted with the WQCB, with a primary 60-mil high-density polyethylene (HDP) membrane or equivalent over a compacted base. The foundation for the pad would be prepared on the permitted phase IV area with slopes less than 5 percent. A layer of geotextile material would be placed over the liner for protection from impact from ore and deformation of the liner. Perforated solution collection pipe would be laid on top of the geotextile to aid in promoting solution recovery from the heap. The pipe network would be designed to provide drainage such that only nominal depths of solution or hydraulic head accumulate on the liner.

Heap Construction. As is the current practice at the heap, crushed ore is proposed to be placed on the pad in 10-foot to 20-foot high lifts to a height of 120 feet. Ore placement would be accomplished by a carefully controlled process of truck end-dumping. Filtered American Girl Canyon mill tailings are disposed on the heap as a part of the agglomeration process.

The outside heap slopes would be constructed with benches between lifts to control runoff and ravelling and to provide an overall outside slope of 2:1 (horizontal:vertical) that provides acceptable short-term or operational slope stability. The reclaimed slopes of the heap would be graded by AGMJV to 2.75:1 to provide acceptable long-term static and seismic stability.

Ponds and Collection Ditches. Collection and storage ponds at the American Girl Canyon heap leach facility to accommodate Oro Cruz ore are proposed to consist of the pregnant and barren ponds currently in use. To increase the emergency capacity of the existing ponds, AGMJV proposes to surround these ponds with a lined containment area. Lined berms surrounding the containment area would act to effectively increase the total pond capacity.

The solution containment capacity required for the American Girl Canyon heap leach operation was

calculated by AGMJV on the basis of the following criteria outlined in the WQCB Order:

- *Containment of the process solution that would drain from the heap during a 24- hour period;*
- *Containment of precipitation and runoff from the pad and solution ponds resulting from the 1-hour probable maximum precipitation (PMP) of 5.00 inches;*
- *Sufficient pond capacity for two feet of freeboard above calculated storage capacity.*

The pond capacity was calculated from the WQCB criteria listed above, in addition to an operational solution volume (required to keep pumps submerged). The process solution that would drain from the heap during a 24-hour period was represented in initial calculations by the assumption that 80 percent of the solution applied in a 24-hour period would drain from the heap.

Leach Solution and Cycle. AGMJV proposes to continue leach solution and cycle procedures currently in use at the American Girl Canyon heap to process Oro Cruz ore. The leach solution is prepared in the carbon plant to a pH of between 9 and 11 and to a cyanide concentration of about 300-600 ppm. The solution is then pumped to the heap from the barren pond and applied to the surface of the heap by an impact sprinkler system at a rate of approximately 0.003 - 0.005 gpm per square foot of heap surface. The expected processing rate for the solution handling is 1000-1500 gpm. Any area where cyanide is used or stored (i.e., the solution ponds, as well as the heap leach pad and mill/process area) is secured with chain link fencing to provide safety and security in these areas. Netting is used as a cover on exposed areas containing cyanide solution to control access to the cyanide by wildlife and birds. The applicant proposes to continue the use of impact sprinklers and netting as part of their cyanide management system if Oro Cruz is approved.

Leaching cycles are first determined through column leach tests performed in the laboratory in 4 to 12-inch diameter columns. Cyanidation times for milled ores are usually measured in terms of hours, but for heap leach ores the time frames are days and months. Ninety days is a very typical heap leach time to extract the majority of precious metals from the ore. Due to the large grain size (crushed material usually 3/8" to 1-inch maximum size), solutions permeate into the rock via fractures and cracks and along grain boundaries. The leaching process, therefore, takes considerably longer in the heap leach compared to milled ores which have a size of less than 100-200 mesh (3/1000 or .003 inch) typically.

Solution application is progressively moved as ore reaches the end of the leach cycle, thereby continuously placing new ore under leach. Subsequent leaching of additional lifts and selected releaching of some heap areas is performed throughout the life of the heap.

Following the cessation of all leaching on the pad, the heaps would be drained for several days and then rinsed with fresh water until solutions show residual cyanide concentration below levels specified in the WQCB waste discharge requirements. The spent ore and tailings would be tested to verify that it has been neutralized in accordance with the WQCB requirement. The heap would then be reclaimed in place on the pad at the end of the mining operation. Closure and reclamation procedures are summarized later in this Chapter of the EIS. Additionally, AGMJV has prepared an American Girl Project

Closure and Post-Closure Plan which provides a detailed description of heap closure and cyanide neutralization plans.

Milling

Oro Cruz ore processing by milling is proposed to take place in the existing American Girl Canyon facilities. No changes are proposed by AGMJV in the existing milling operation to accommodate Oro Cruz ore. The current milling process is described below.

The high grade ore to be milled is first crushed in the crushing plant, from which the ore is discharged to a fine-ore stockpile. Dust suppression in the crushing plant is provided by water sprays. The fine ore is further crushed in a ball mill grinding circuit in which lime and barren solution are added to create an ore pulp. Coarse gold can be extracted from this pulp via a gravity separation process; however, most of the pulp is pumped through a series of four aerated leach tanks for an approximate retention time of 48 hours. Sodium cyanide is metered into the first and third tanks in carefully measured quantities to maximize metallurgical extraction. The consumption of sodium cyanide in the mill process is approximately 1 lb per ton of ore. The maximum mill throughput rate is about 960 wet tons of ore per day (about 350,000 tons per year).

Once the leaching cycle in the tanks is completed, the gold (which is now in solution) is separated from the pulp, or tailings, via a two-step vacuum filtration dewatering process. The solids (tailings) are separated from the liquids during this process by drawing the liquid solutions through a cloth covering the vacuum drum. Solids from the first stage of filtration are repulped with water, then refiltered and washed to attain maximum recovery of both the gold and the reagents. The gold-bearing solution is then pumped to the pregnant solution tank. The waste material (tailings) falls onto a belt conveyor, from which it is transferred to a radial stacker conveyor and deposited on a lined temporary storage pad until agglomeration takes place (see next section).

Very little material is removed from the ore in the process of gold recovery. In addition to the gold and silver values, small amounts of base metals are dissolved, the exact quantity depending on the chemical form in which the metals are present. For practical purposes of controlling the plant, outgoing tailings are considered to be the same weight as the ore entering the plant.

Disposal of Tailings from Milling

Since operations began at American Girl Canyon, dewatered tailings have been co-disposed with the waste rock produced from open-pit mining. This process involved washing and dewatering the tailings (to a free cyanide level of less than or equal to 5 ppm), subsequently allowing natural drying, and then placing the tailings product in the waste rock disposal areas.

However, the California Regional Water Quality Control Board has recently changed its policy toward the disposal of tailings as Group C (inert) waste. This change in policy has eliminated continued co-disposal of tailings with waste rock at American Girl Canyon operations. To meet the provisions of the new WQCB policy, AGMJV has begun a process to agglomerate mill tailings from American Girl

Canyon ore and dispose them upon the existing American Girl Canyon lined heap leach pad.

Conceptual efforts to develop the new agglomeration system at American Girl Canyon began in February, 1993. Approval for agglomeration was obtained from the WQCB at that time. Actual efforts to implement agglomeration began in September 1993. This operational change occurred independently of any decision on Oro Cruz development. If Oro Cruz is approved and developed, AGMJV proposes that the agglomeration process also be used for tailings from the milling of Oro Cruz ore.

The process of agglomeration is applied in a wide variety of industries where fine particulate matter is packed together to form a larger particle. At the American Girl Canyon facilities, fine mill tailings are blended in an approximate 50/50 (weight basis) mixture with heap ore in the agglomeration process conducted within a pug mill located on top of the heap. Tailings are filtered in the mill in much the same manner as previously practiced except the cyanide level is not reduced by rinsing with clear water. Cyanide levels will be maintained because the final destination for the material is the heap leach pad, where the tailings and heap ores will undergo further leaching on the lined pad.

Tailings are conveyed from the existing discharge pad to the top of heap leach Phase I and II, and temporarily stockpiled prior to agglomeration. The access ramp for delivering tailings from the discharge end of the mill to the heap area will be lined with a 60 mil HDP liner where the route currently crosses an unlined area. All areas which will be used as the access route for the tailings from the mill to the heap leach will therefore be fully lined and bermed.

Similarly, a portion of nominal - 3/4 inch heap leach ore will be hauled to a separate stockpile on Phase I/II. Feed from each of these stockpiles will be fed into the agglomeration process. An entirely portable operation is anticipated so that as agglomerated ore is stacked, the entire agglomeration setup can retreat across the top of the pad. Agglomerated ore will be stacked in one or more lifts until the permitted heap height is reached.

During agglomeration, a binder addition will take place to bind the fine particles (tailings) to the coarse materials (leach ore). Cement and polymers are likely binding materials for use at American Girl Canyon. A small storage silo and/or a truck trailer containing these binders will be located near the pug mill.

The agglomerates will be conveyed away from the agglomerator and a small radial stacker will form a kidney shaped pile of agglomerates ready for cure time. Each kidney shaped pile should contain approximately a week of fine tailings and completion of the agglomeration step would fall on a Thursday or Friday, allowing the 48 hours of the weekend as "cure time." Agglomerate strength is typically sufficient to allow re-contouring of the piles formed by the radial stacker. A smooth surface on the top of the agglomerate piles is not necessary, but is beneficial for placement of sprinkler or drip emitter cyanide solution lines. The continuing increase in heap height up to 120 feet will be maintained at the design heap overall slope of 2:1.

Placement of the agglomerates is being restricted for two reasons. First, should there be any unforeseen impediment to achieving full detoxification, the entire zone of agglomerates would be in a defined location for separate treatment, or as a last resort, removal for

treatment or disposal. The second reason for restricting placement is to ensure no significant load is placed on top of the agglomerates that might break down their structure, leading to percolation problems.

Two operators will perform the agglomeration duties. A routine part of the operation work will be to fill out process data sheets including hydrogen cyanide monitoring via a handheld monitor meter. Cyanide exposure will be within Mine Safety and Health Administration, National Institute of Occupational Health and Safety, and California Occupational Safety and Health Administration limits. Limits for these workers will be the same as those for truck drivers, heap leach operators or others working around the cyanide solutions.

Normal heap leaching and stacking will continue on Phase III (and Phase IV if Oro Cruz is approved and developed) of the American Girl Canyon heap facility. The agglomeration effort will take place independently of these normal heap operations.

Electrical Power Supply and Fuel Storage

The power requirements for the proposed Oro Cruz operation include both electricity and liquid fuel. Electricity requirements would be minimal, and AGMJV proposes that electricity be generated at the existing American Girl Canyon generating facility. An overhead powerline would be installed by AGMJV along the access road from American Girl Canyon to the Oro Cruz underground mine. The maximum electrical power requirement for the underground would be 1,000 kw.

Liquid fuel for Oro Cruz open-pit development is proposed to be stored and dispensed from the American Girl Canyon site by use of a service vehicle. A 12,000 gallon liquid fuel tank at the Oro Cruz site would be established once the underground development is initiated. The fuel storage tank would be located adjacent to the underground portal and would be within a lined containment area to minimize any impacts from spills.

Water Source and Supply

Exploration drilling has indicated that a groundwater source adequate for mining requirements does not exist in the Oro Cruz area. There are however, extensive underground workings below the proposed Cross Pit that have been flooded by surface runoff. Due to the proximity of these flooded workings to the area of planned underground mining, a dewatering program would be necessary prior to underground development. The dewatering program would consist of an 8-inch diameter water well drilled to intercept the area of deepest known underground workings. Water pumped from these workings is proposed to be used to fulfill operational water requirements. The water would be pumped to a 50,000 gallon storage tank and used for the mining and fire protection requirements. When the dewatering well is no longer capable of supplying water, AGMJV proposes to install an 8-inch diameter water line from American Girl Canyon along the Oro Cruz access road to an area adjacent to the underground portal within the Cross pit.

The current well, located three miles southwest of the American Girl Canyon facilities, has a capacity

for 300 gpm and the pump a capacity of 400 gpm. The well is completed in alluvial deposits that occur along the southwest margin of the mountain front. The water usage since 1988 has been approximately 170 gallons per minute (gpm) 24 hours per day or 89 million gallons (274 acre-ft) per year. During the past three years of operation there has been no measurable effect to the water table level that was originally observed in 1987.

The AGMJV is permitted to use up to 484 acre-ft per year. The maximum yearly consumption associated with Oro Cruz is not expected to exceed 300 acre-ft per year, although water use would be greatest during the heap rinsing process occurring with American Girl Project closure and reclamation. A 50,000 gallon water tank is proposed to be located at the Oro Cruz site to provide adequate water storage for the project's mining and fire protection requirements.

Sanitary and Solid Waste Disposal

All sanitary wastes are proposed to be disposed of in an on-site, state-approved leach field at the underground facilities. All trash would be handled in accordance with applicable federal, state and county laws. Refuse would be hauled to an approved landfill facility. No hazardous wastes are currently known to be associated with the operation and would, therefore, not be handled or disposed of on-site. Future use of any hazardous wastes of any sort would require prior BLM approval. Hazardous material would be shipped off-site by licensed haulers of hazardous waste and deposited in a licensed hazardous waste facility. Sodium cyanide containers used at the American Girl Canyon processing facilities would be returned to the supplier for re-use.

Fencing, Security and Administration

Access into the Oro Cruz area is proposed to be limited to AGMJV personnel by means of security fencing in strategic locations. Because of the size of the disturbance area, fencing the entire permit perimeter was determined by AGMJV to be prohibitively expensive and unnecessary, given the rugged terrain and generally impassible access over the mountainous portion of the permit area. AGMJV proposes to fence the entrance to the operation area in Tumco Wash and the downslope side of the haul road between the Oro Cruz and American Girl Canyon operations. This security fence would be installed during the construction phase of the inter-canyon haul road. Security personnel would patrol the area to limit access of unauthorized personnel until construction of the fence is complete.

In addition to security fencing, certain additional fencing is required to protect the desert tortoise. To reduce the probability of direct and indirect tortoise mortality resulting from mining operations, AGMJV proposes to install tortoise-proof fencing along the western boundary of Tumco Wash, the American Girl Wash haul road corridor, and part of the existing American Girl Canyon fence. A tortoise-proof earthen berm along part of the western American Girl Canyon security fence would also be built. All tortoise habitat above the Tumco Wash fence, within the fenced haul road corridor and south of the haul road fence that is east of the American Girl Canyon security fence would be cleared of tortoises.

AGMJV proposes that the existing security station located at the entrance gate to the American Girl Canyon operation be used to regulate traffic into the

Oro Cruz site. All traffic associated with the American Girl Project operation is currently required to enter and exit through this security gate which would continue to be monitored 24-hours a day.

Fire Protection

Adequate fire protection is an important component of any mining operation, both for protecting the personnel, resources, and facilities of the mining company and for maintaining compliance with regulations imposed by MSHA as well as by applicable state and county building codes. AGMJV proposes to continue and extend the current training program to the Oro Cruz operation. A rehearsed fire fighting plan would be included in the training. The water tank discussed previously would be available to provide water for fire protection.

Emergency Response

An "Emergency Notification Plan" (ENP) has been prepared for the American Girl Canyon and Padre Madre operations. The plan covers actions to be taken in the event of an on-site spill, fire, release of toxic gas or any other emergency. These actions include notification procedures, as well as shutdown/evacuation procedures and cleanup countermeasures, as needed. The ENP includes a list of critical materials and storage locations on site, as well as loading and unloading procedures, containment structures, surveillance, and inventory control procedures for these critical materials. Also included in the plan is a list of safety and emergency response equipment on-site, as well as a personnel safety training program. AGMJV proposes to modify the existing plan to include Oro Cruz prior to the beginning of Oro Cruz construction.

Reclamation

A Reclamation Plan for the American Girl Project has been prepared to comply with BLM regulations (43 CFR 3809) and the California Surface Mining and Reclamation Act of 1975 (SMARA). The Reclamation Plan focuses on the procedures proposed to enhance re-establishment of a productive ecosystem by re-establishing wildlife habitat and achieving visual compatibility with the surrounding landscape. The physical aspects of reclamation such as grading, drainage establishment, waste rock and pit wall stability, and pollutant containment, including detoxification of the heap, are discussed in the American Girl Project Closure and Post-Closure Plan prepared to comply with the requirements of the California Regional Water Quality Control Board. There is significant overlap between the goals and objectives of these two plans. The discussion below is an integrated summary of the two plans.

Reclamation Approach and Goals. The proposed Oro Cruz operation would be located in a hot desert climate where conditions of minimal water, skeletal soils and high temperatures require a reclamation plan significantly different from plans for less arid regions. Typical reclamation methods, such as drill or broadcast seeding, may not produce adequate results for the harsh climatic and edaphic conditions of this site. Even experimental revegetation results from other desert regions, such as the Sonoran Desert, are not applicable to the Cargo Muchacho Mountains where conditions for plant growth are exceedingly harsh.

AGMJV proposes the following to achieve successful reclamation at Oro Cruz:

- *Establish stable surface, topographic, and drainage conditions that are compatible with the surrounding landscape. This would be accomplished during operations by material placement and grading, and after closure by final grading and contouring;*

- *Establish, where possible, surface "soil" conditions conducive to natural regeneration and native plant establishment through the selective application of top-dressing material that has suitable characteristics (e.g., material that is non-saline, nontoxic and medium textured);*

- *Leave some slopes, particularly in the waste rock disposal area and remnant pit slopes, as talus-like slopes somewhat reminiscent of the surrounding rocky hillsides due to the extremely limited quantity of fines for use in covering waste material. These surfaces would be re-contoured for slope stability and visual compatibility;*

- *Establish revegetation research plots early in the life of the operation to aid in determination of final revegetation methods and plant materials;*

- *Supplement natural plant regeneration through experimental revegetation efforts to selectively seed and transplant native species in microsites specially created for the "harvesting" of moisture; and*

- *Consider public safety through the stabilization, removal, and/or fencing of structures or landforms that could constitute a public hazard.*

Because of the desert climatic conditions, surface stabilization emphasizes contouring and drainage control as opposed to stabilization through revegetation. Revegetation is desirable from the standpoints of vegetation productivity, aesthetics and wildlife habitat; however, it cannot be established at a density that would generate slope stability through root mass and penetration. Because stability on natural, undisturbed slopes is provided by landform rather than vegetation, the basis for AGMJV's proposed site reclamation initially lies with the physical manipulation of on-site topography for stabilization and then with revegetation for aesthetics and wildlife habitat.

The reclamation procedures are designed to use precipitation with surface runoff water management. The only watering of transplants would be with onsite watering trucks at the initial time of transplanting, if necessary. AGMJV has proposed a minimal-irrigating approach to vegetation establishment because of the poor quality of water, the need to avoid a dependence by the plants on irrigation for continued existence, and the lack of significant success with other irrigation studies in these isolated desert habitats. If plants germinate naturally in a specific site and survive without artificial watering techniques, chances increase for long-term successful revegetation.

Successful reclamation requires adequate preliminary planning and design to ensure that post-mining conditions are conducive to productive use of the land. The proposed site would be returned to wildlife habitat/open space as post-mining land use.

This planning for final closure of the Oro Cruz facilities would be an extension of the on-going work at the American Girl Canyon and Padre Madre operations.

Reclamation Scheduling. Reclamation activities are proposed to be timed to take advantage of optimal climatic conditions at the Oro Cruz site. Given that most of the annual precipitation occurs during the cooler winter months (from late fall through early spring) all seeding activities would be conducted during the early-to-late fall period (i.e. October through mid-December). Timing of transplantation activities would be slightly more flexible, particularly if supplemental watering is used, but would generally take place during the cooler winter months. Thus, grading and drainage control establishment and maintenance are likely to be conducted during the spring and summer months.

Revegetation Research Plots. At the American Girl Canyon operation, AGMJV is working to establish a stable, self-generating vegetation community that mimics the vegetation of the surrounding area to the greatest extent possible. In order to achieve this end, the implementation of the test plot program began in early 1990. The test plots are periodically monitored to determine the most effective revegetation strategy and species that are most adaptable to transplantation and reseeding. Research to date has indicated that the best candidates for transplantation efforts are ocotillo, creosote bush, inciensio, palo verde and a variety of cacti including jumping cholla.

Soil Handling. As is the case with the American Girl Canyon and Padre Madre operations, no formal soil salvage operations are proposed for Oro Cruz because topsoil is essentially nonexistent in the area. Instead, a surface top-dressing with suitable texture and no toxic or saline characteristics would be used in very localized areas. The top-dressing material is limited in the area. The goal of reclamation, therefore, is not to salvage and stockpile soil material, but to select suitably textured surface and/or subsurface excavation materials as a suitable plant growth medium for reclaimed surfaces.

Because the availability of even this type of fines material is very uncertain, it is likely that large portions of the reclaimed surface would consist of small pockets of fines (in which plants could become established) and would be interspersed at varying intervals with uncovered waste rock. This circumstance is unavoidable, given the lack of salvageable soil within the project area.

Vegetation Clearing/Transplantation. No clearing of vegetation per se is proposed because of the low density of vegetation. However, a number of individual plants (various species) are proposed to be removed from areas to be disturbed prior to the commencement of construction activities. The species to be used for transplantation would be selected on the basis of availability and their likelihood of survival. As noted previously, the most likely candidate species are ocotillo, creosote bush, inciensio, palo verde and cacti.

Transplanting is proposed to be completed during the cool winter months (November through February) in order to maximize the chances of seedling survival and utilize natural precipitation, which is most likely to occur during these months. Some custodial care of transplanted shrubs may be required; for instance, hand watering of individual transplants may be necessary, particularly if the year is drier than average. Watering, if required, would be tapered off

toward spring and completely halted before the hot season arrives.

Revegetation. Successful revegetation in the harsh desert climate of the Oro Cruz project area would be difficult. In addition to the climatic and edaphic constraints, there is the problem of finding a suitable native seed source. Collection of seeds would be integrated with the revegetation research program previously outlined.

Many areas (steep slopes, south facing slopes, rock outcrops, etc.) are not conducive to revegetation. Therefore, not all of the "disturbed" area is proposed for revegetation. As shown in Table 7, approximately 382 acres of the American Girl Project disturbance area would be revegetated (including 135 acres at Oro Cruz).

Given the harsh conditions and existing natural environment, a vegetation cover of approximately 3 percent is proposed as the goal of revegetation efforts.

Revegetation efforts would be concentrated in the artificial depressions and drainages developed during the final grading and contouring stages. These areas would act as water catchments, collecting more available water than the higher surrounding area and creating a microenvironment where the chances of successful revegetation are increased. Final revegetation would be initiated upon the completion of surface mining.

BLM and Imperial County would remain involved in reclamation planning throughout the project life. Both agencies reserve the right to require specific reclamation techniques or additional mitigation measures at any time during this process.

Heap Leach Reclamation. The goal of reclamation in the heap leach area is proposed to focus on the creation of contoured, naturally revegetated areas that blend unobtrusively into the gentle slopes surrounding the leach site. Heap edges or outslopes would be

TABLE 7

PROPOSED REVEGETATION AREA (ACRES)

	Padre Madre	American Girl Canyon	Oro Cruz	TOTAL
Heap	25	40	0	65
Waste Dumps	16	40	45	105
Roads and Service Area	32	36	50	118
Pits	16	15	10	35
Underground	0	9	0	9
Gravel Pits	0	20	30	50
TOTALS	83	164	135	382

regraded after detoxification is complete. Outslopes would be reduced from overall slopes during operation of 2H:1V to reclaimed slopes of 2:1 to 2.75:1. Thus, the sharp contours of the heap would be appreciably softened and the graded material would extend outward far enough to obliterate the perimeter berm that encircled the heap during active operations. Grading of the heap would be conducted so as to leave in place the interceptor ditch around the heap, thereby diverting all runoff away from the heap area.

After recontouring, microsite hollows are proposed to be selectively filled with a top-dressing of suitably textured material. Revegetation would then proceed in the manner determined to be most effective during the course of the test plot research program. Selective seeding and transplanting is proposed to be accomplished in the microsite hollows created for that purpose. Transplants would be scattered in a random pattern and would be planted at higher densities on the cooler north-facing slopes than elsewhere on the heap. The overall goal of revegetation on the heap, as well as on other project site disturbances, would be to achieve about a three percent vegetative cover on upland slopes.

Open Pit and Waste Rock Reclamation. An overall slope gradient of 2H:1V is proposed in waste rock areas, although in some areas flat benches would alternate with slopes of 1.5H:1V to achieve the overall 2H:1V slope. In the Cross pit (which is not proposed for backfilling) vertical sections of highwalls would alternate with flat benches. The end result would be a new landform which can, to some extent, be topographically blended with surrounding slopes.

The flat benches of the waste rock disposal areas would be ripped and/or scarified to produce rough surfaces for the anchoring of any top-dressing materials that may be available, as well as to provide a more hospitable environment for plant growth in those areas that do not receive a top-dressing of soil fines. Surface material would be left in a loose, cloddy condition to aid in moisture retention, decrease wind erosion losses, and encourage establishment of seedlings in small surface crevices. Some small depressions would be left in the surfaces to aid in moisture retention. These areas would be used for seeding native species and transplanting selected native shrubs.

Road Reclamation. After roads are abandoned, AGMJV proposes grading to re-establish natural drainageways. All culverts would be removed, and the crossings would be contoured to approximate the pre-existing drainages. Roads would be "outsloped" to permit natural drainage. This would be done by "pulling" the berm and spreading it across the road. Borrow ditches would be filled to permit outsloping and allow water to drain off the corridor area. Intersecting dips or water bars, if required, would be installed. The compacted roadbed would be ripped to a depth of at least 10 inches prior to revegetation.

Reclamation of Surface Disturbances Associated with Underground Mining. AGMJV proposes to backfill underground workings to control underground subsidence and movement. Based on the experience at American Girl Canyon, the applicant proposes to backfill approximately 70% of the underground workings, with the main underground access, the ventilation declines and certain development drifts remaining open.

Once underground mining has ceased, the mine entry would be permanently closed, either by blasting and recontouring the entryway or by sealing it with a locked steel gate in accordance with MSHA requirements. All ventilation shafts to the surface would be sealed with concrete plugs or other devices in order to make the shafts acceptable for future use by bats.

Buildings associated with the underground development would be removed by the applicant. The area would be regraded to blend with surrounding topography and to re-establish natural drainageways. Compacted areas would be ripped, and suitable top-dressing materials would be applied. Revegetation as previously described would follow.

Summary of Proposed Environmental Protection Measures

As part of the proposed action, AGMJV has proposed measures which would lessen the potential adverse effects associated with Oro Cruz development and operation. The general types of methods which reduce or negate environmental impacts include:

- *avoiding the impact by not taking all or a part of a certain action;*
- *minimizing impacts by limiting the degree or size of an action through engineering and management actions by the proponent;*
- *rectifying the impact by repairing, rehabilitating or reclaiming the affected environment;*
- *reducing or eliminating the impact over time by preservation or maintenance; and*
- *compensating for the impact by replacing or providing substitute resources or environments.*

Many measures intended to reduce potential environmental impacts would be implemented by AGMJV through existing rules and regulations. Preliminary planning and design efforts for the proposed operation have incorporated provisions for compliance with these rules and regulations and considered initial BLM concerns. A summary of environmental protection measures proposed by AGMJV is presented in Table 8 and discussed below. Additional mitigation measures identified by BLM are discussed in Chapter 4 of this EIS.

Air Quality

Unpaved haul, service, and access roads within the area would be sprayed with water on a regular basis to reduce fugitive dust emissions from vehicular traffic. Water sprays would be provided at the crusher and at conveyor transfer points to reduce particulate emissions. Surfactants which would not create a hazardous or toxic condition might be added to the water to enhance dust control. Low sulfur fuels would be used to reduce SO2 emissions in development and mining operations. Baghouses on the lime and cement silos are proposed to further reduce particulate emissions.

TABLE 8

SUMMARY OF POTENTIAL ENVIRONMENTAL EFFECTS AND PROTECTION MEASURES INCORPORATED INTO APPLICANT'S PROPOSAL

Potentially Identifiable Environmental Effects	Environmental Protection Measures
AIR RESOURCES	
Adverse air quality effects due to fugitive dust and other emissions.	Incorporation of emission control technologies such as baghouses would reduce emissions. Water sprays would be provided at crusher and conveyor transfer points for dust suppression. Surfactants may be added to enhance dust control, if necessary. Access and haul roads would be sprayed with water on a regular basis, or alternative dust suppressants would be used. Dust emissions would be monitored for the duration of project operation and control measures improved, if appropriate.
GEOLOGY/GEOTECHNICAL	
Consequences of potential slope instability and/or ground settlement at waste rock dump and heap sites.	Structures and facilities would meet current applicable seismic safety standards. Artificial slopes constructed at an angle of repose would be benched as necessary to increase slope stability. Regular monitoring of facilities would be conducted to detect changes.
Erosion due to modification of natural drainage and infiltration characteristics, and pressure of constructed slopes.	Access and haul roads would be constructed of onsite materials and primarily follow natural contours. Waste rock facilities would be constructed with benched slopes and top surfaces would be sloped to control runoff. Facilities would be located outside of major drainages. Runoff into mine pits would be contoured within the pit.

TABLE 8 Cont.

SUMMARY OF POTENTIAL ENVIRONMENTAL EFFECTS AND PROTECTION MEASURES INCORPORATED INTO APPLICANT'S PROPOSAL

Potentially Identifiable Environmental Effects	Environmental Protection Measures
GEOLOGY/GEOTECHNICAL Cont.	
Loss of potentially economic ore.	Option to recover additional ore would remain by not backfilling Cross Pit.
Slope instability in the mine pits.	Slopes in the mine pits would be designed specific to the configuration and rock conditions of each wall. Unstable pit wall slopes encountered in mining would be stabilized by modification of bench widths.
WATER RESOURCES	
Degradation of groundwater quality due to potential fuel spillage in mine pit.	Fuel storage areas would be contained.
VEGETATION	
Loss of about 116 acres, with estimated 2-5% vegetative cover.	Revegetation/reclamation plan includes seeding and transplantation program. Revegetation research program would continue.
WILDLIFE	
Direct effect on marginal Desert Tortoise habitat. Other types of effects include direct mortality and displacement.	All mitigation measures required by Biological Opinion.
Direct disturbance to other wildlife and loss of habitat.	Fencing and barriers would be established to discourage wildlife from entering the active mining area.
LAND USE	
Proposed operation essentially limits future re-use of mine pit, waste rock dumps and heap leach areas.	Proposed reclamation and closure activities would return some land to previous use and productivity.

TABLE 8 Cont.

SUMMARY OF POTENTIAL ENVIRONMENTAL EFFECTS AND PROTECTION MEASURES INCORPORATED INTO APPLICANT'S PROPOSAL

Potentially identifiable Environmental Effects	Environmental Protection Measures
LAND USE Cont.	
Potential public safety problem related to unauthorized use of the reclaimed site.	Fencing and employment of security guards would discourage unauthorized entry and minimize potential hazard of remaining facilities.
VISUAL RESOURCES	
Visibility of operation from Ogilby Road would present noticeable modifications of the existing landscape.	Reclamation and closure would reduce the impact.
SOUND	
Development and operation of the mine pits would generate single event noise from blasting and there would be ongoing noise associated with vehicles and equipment operation.	Blasting would be limited to daylight hours and occur for durations of no longer than one hour.
CULTURAL RESOURCES	
The proposed development would indirectly affect the Hedges/Tumco Historic Townsite, considered eligible for the National Register.	A Treatment Plan would be prepared and implemented to mitigate the effects of project development on potentially eligible sites. The Treatment Plan would be approved by BLM and SHPO, as part of a determination of No Adverse Effect. Other cultural sites would be evaluated and mitigated as necessary.
PUBLIC AND EMPLOYEE HEALTH AND SAFETY	
Potential accidents associated with unauthorized entry to the mining area.	Perimeter of operation area would be fenced and posted with warning signs to prevent unauthorized entry. 24-hour security would provide effective deterrents.
Potential accidents associated with entry onto the reclaimed mine site.	Regrading and recontouring would minimize potential hazards.

TABLE 8 Cont.

SUMMARY OF POTENTIAL ENVIRONMENTAL EFFECTS AND PROTECTION MEASURES INCORPORATED INTO APPLICANT'S PROPOSAL

Potentially Identifiable Environmental Effects	Environmental Protection Measures
PUBLIC AND EMPLOYEE HEALTH AND SAFETY Cont.	
Employee safety concerns include industrial safety and industrial hygiene issues.	Medical, fire suppression and communications equipment maintained at the American Girl Project property would be available as necessary. Operation would comply with applicable MSHA standards for achievement of a safe working environment.
CYANIDE MANAGEMENT	
Potential hazards from cyanide transportation, containment, storage and mining.	Proposed action would continue existing management practices (see text).
Potential hazards to wildlife, worker health and safety and water resources from use of cyanide at mill and heap leach area.	Use of containment areas, addition of lime to control pH, covering of open solution with netting and use of liners would continue as part of the proposed action. Processing facilities would continue to be regulated as a zero discharge site per requirements of the RWQCB. A specific, regulated limited concentration of free cyanide is allowed to remain entrained in the waste material, which is monitored in detail.

Geology

Project structures would be designed in accordance with Seismic Zone 4, the most stringent zone of the California Uniform Building Code. Potential slope instability would be mitigated by constructing slopes at angles specific to the configuration and composition of each pit wall or pile. Facilities would be benched as necessary to minimize slope movement. Where possible, dumps would be bermed and the tops would be graded to direct precipitation away from sloped areas. In addition to the direct benefit of reducing runoff at steep slopes, this would increase the potential for growth of native vegetation to provide additional erosion control. Other facilities involving artificially constructed slopes of soil or rock, such as drainage and diversion structures would be designed to avoid the possibility of substantial slope movement during a seismic event.

Hydrology

Drainage diversion ditches would be provided as necessary to protect mine pits, stockpiles, roads and

structures from infrequent storm flows. Engineering of these structures would provide assurance that re-directed flows did not exceed flood protection requirements. Drainage design would minimize interruption of natural drainage paths to the extent practical. If runoff from larger storms caused ponding in the mine pits, temporary dewatering would be necessary.

Wildlife

Fencing would be provided around the operational area to discourage wildlife from entering the active mining and processing areas. The level of human and equipment activity and associated operational noise would also be a deterrent to approaching wildlife. AGMJV would be responsible for compliance with environmental mitigation terms identified for threatened or endangered species in the Biological Opinion.

Vegetation

Construction disturbances would be confined to the immediate development area. Operational disturbances would be limited to currently active operational locations. A revegetation program would be coordinated with the revegetation research program being implemented at the existing project operations. Results of the program have been used in determining appropriate revegetation activities at the Oro Cruz operation. The absence of project equipment and activities after cessation of mining would allow some natural reestablishment of indigenous vegetation. The revegetation/ reclamation plan includes a seeding/transplantation program to revegetate disturbed lands.

Soils

Roads and facilities would be constructed such that modifications to natural onsite drainage and infiltration characteristics, and related soil erosion, would be minimal. Onsite materials would be used to construct the roads which, to the extent practical, would be graded to follow natural contours. The effect of erosion due to redistribution of diverted runoff would be lessened by:

- *directing storm runoff flows to the approximate locations where they would have occurred without the proposed action, and*

- *designing diversion ditches with flow conditions which would not be substantially different from existing conditions.*

Periodic inspections of diversion structures and the downgradient washes would be conducted.

Land Use

Vehicular access to the site would be restricted. In addition, the following measures would minimize potential hazards related to unauthorized use of the reclaimed mining and processing sites:

- *re-grading roadways and ditches to adjacent contours,*

- *removing buildings and structures,*

- *stabilizing pit slopes by excavating or blasting,*

- *stabilizing waste rock dump slopes at the natural angle of repose, and*

- *providing consolidated earth and rock berms at the entrances to the mine pit access roads to prevent vehicular access.*

Generally, much of the disturbed land would be allowed to return to a post-mining land use of wildlife habitat/open space.

Visual Resources

Siting of the waste rock dump in its proposed location and use of existing processing facilities at American Girl Canyon are efforts by AGMJV to reduce potential visual impacts of the proposed operation. To further lessen the visual effect of operational components, natural vegetation would be re-established through seeding and transplantation.

Recreation

The primary recreational resource which would be indirectly affected by Oro Cruz development is the Hedges/Tumco historic townsite. Oro Cruz facilities have been located to avoid direct conflict with recreationalists who visit this site.

Cultural Resources

Siting of operational components and use of existing processing facilities at American Girl Canyon are proposed to lessen potential impacts to important cultural resources in the Tumco/Hedges area. Mitigation of potential impacts to cultural resources would be conducted according to a Treatment Plan, which would be approved by BLM and SHPO as part of a determination of No Adverse Effect. Measures specified in the Treatment Plan would be completed prior to initiating development of Oro Cruz operating activities in any specific area. Development specifications for the operation would include requirements that vehicular activity be limited to specified areas to minimize the potential for damage in presently undisturbed areas. Measures to limit the extent of vehicular activities would include:

- *the requirement to provide specially flagged stakes at the perimeter of development areas, and*

- *instructing construction workers and employees as to the sensitivity of desert vegetation, wildlife, archaeology, and the purpose of the construction limit stakes.*

Sound

Blasting would be conducted only during daylight hours and would not occur for periods longer than one hour. Typically, blast events would last no longer than several seconds.

Public and Employee Health and Safety

Unauthorized entry would be prohibited during and after operations through posting of warning signs, fencing, the project security station, and appropriate closure of the facilities. In the event of an accident, trained personnel are available on-site. An onsite communication system would link the various areas of the project and connect to the public communications system. The operation would comply with applicable

MSHA standards for achievement of a safe working environment. Water storage and fire suppression equipment are located on-site for prompt response in the event of a fire at the project.

Cyanide Management Procedures

AGMJV proposes to use existing operational procedures for cyanide management associated with Oro Cruz processing. A cyanide management program is presently in place and would continue through the life of the Project, including the Oro Cruz operation if it is approved and implemented. The plan is designed to accomplish the following goals:

- *Provide a secure area for the storage and use of sodium cyanide.*
- *Provide a safe work area for employees.*
- *Ensure that a "zero discharge" environment is maintained at all times.*
- *Provide effective measures to eliminate wildlife contact with cyanide-bearing solutions.*
- *Provide an effective emergency plan in the event of accidental release of cyanide.*
- *Provide an effective program of decommissioning and closure to insure that environmental quality is not compromised when mining is completed.*

Elements of the cyanide management program currently in place are described below.

Security. The AGMJV mine site is protected from outside intrusion by a six foot cyclone fence with razor ribbon. In addition to the security fence limiting access to the mine property, a second cyclone fence encloses the area of the leach pads and ponds and the area of sodium cyanide storage. Access to these areas is strictly limited to essential personnel. Signs printed in English and Spanish are prominently displayed on this fence warning of the cyanide hazards.

The amount of dry sodium cyanide stored on the property is commensurate with the operational requirements. Typically, deliveries of sodium cyanide are made on a bi-weekly basis.

Safety. All personnel who work in the processing area are regularly trained in all aspects of the cyanide management program. The training program is designed to increase employee awareness as to the risks associated with cyanide and to train employees in the proper handling of cyanide and the specific counter measures to be taken in the event of accidental release or exposure to cyanide.

Individuals mixing cyanide are required to use proper safety apparel, including air respirators, rubber gloves and goggles. The mixing area in monitored by stationary "monotox" units which sound an alarm when cyanide concentrations in air reach 4.7 ppm, the OSHA Short Term Exposure Limit (STEL). Hand held monotox units are used in the heap pad and pond areas, where cyanide readings are taken and recorded on a daily basis. These are tabulated and reported quarterly to the Imperial County Air Pollution Control District. In order to prevent the formation of cyanide

gas, a solution pH of 9 to 11 is maintained by addition of lime to the crushed ore.

All employees are trained in first aid measures to be taken in the event of personal exposure to cyanide. Cyanide antidote kits are located in clearly marked areas throughout the process area.

Maintaining a "Zero Discharge" Environment. Active release of cyanide is strictly regulated by two of the largest compliance/regulation bodies in the state of California, the California Regional Water Quality Control Board (WQCB) and the California Air Resources Board (ARB).

A "zero discharge" environment is in place throughout all phases of the processing circuit. Measures taken to insure that cyanide is not released include:

- *In the process plant area, all cyanide processing occurs within concrete lined areas. Tank areas are bermed to contain spills, with a containment volume equal to that of the tank storage capacity.*

- *The heap leach pad is underlain by a 60 mil HDP liner. The liner is installed under a stringent program of quality control and quality assurance, as specified by the WQCB. A 12 oz., 110 mil. geotextile membrane is placed immediately above the liner to prevent puncture.*

- *The leach pad area is underlain with compacted soils. Included in the pad construction is a vadose zone monitoring system to detect leakage from the pad.*

- *Heap leach ponds are double lined with 60 mil. HDPE. A leachate collection and recovery system (LCRS) is installed between the two liners.*

- *All areas of piping not directly underlain with liner are designed with a double containment piping arrangement to guard against uncontrolled release if a pipe failure should occur.*

- *A hydraulic monitoring system is in place to permit measurement of the hydraulic head over the liner.*

- *A network of four monitor wells are located around the leach pad and ponds to detect any release of cyanide solution.*

AGMJV conducts a methodical program of monitoring the "zero discharge" state. The LCRS, vadose zone and hydraulic head indicators are monitored weekly. Monitor wells are pumped on a quarterly basis and sampled on a monthly basis, with water samples analyzed by a California certified lab. All results of monitoring and sampling are reported to the WQCB, the Imperial County Health Department and the Imperial County Planning Department.

Protection of Wildlife. AGMJV has taken a variety of steps to limit wildlife exposure to cyanide. Current measures taken to exclude wildlife are as follows:

- *Leach ponds are covered with a 2" mesh nylon netting suspended over the ponds by wire ropes. Where the suspended netting intersects the edge*

of the pond, additional netting is draped along the sides to prevent any animals from entering the pond area.

- *Solution ditches surrounding the leach pad are covered with crushed rock from the leach pad to eliminate exposed cyanide solution. Drainage of the ditches is provided by buried 3" perforated PVC pipe along the bottom of the ditch.*

- *The area on top of the leach pad is regularly ripped with a dozer to increase surface permeability and minimize solution ponding.*

- *Sonic repellents are used in the pond area as a hazing method for birds. The guns have a rapid fire mechanism and are set to fire at irregular intervals and with rapid percussion.*

In October, 1992, a program to reduce bird (avian) mortality was implemented by AGMJV. Employees working in the area of the pad and ponds are required to conduct daily surveys to insure that all netting is in place, sonic repellents are operating and significant ponding is not occurring on the leach pad. Any avian mortalities are immediately reported to the environmental coordinator, who identifies the species, records the location of the mortality and determines if remedial action is necessary to prevent a recurrence. All data concerning wildlife mortalities are reported to the BLM on a monthly basis.

Due to continuing concern over the mortality from cyanide issues, AGMJV is also proposing a modification of their current netting system if Oro Cruz is approved. AGMJV is proposing a change to a finer net mesh of 1" by 1" rather than the 2" mesh currently in place.

Decommissioning and Closure. A detailed Closure Plan has been submitted to the WQCB that outlines the proposed activities to be conducted when mining is completed. To eliminate future environmental degradation, residual cyanide in the American Girl Canyon heap will be degraded by an extended program of rinsing with fresh water. The heap will not be abandoned until free cyanide has been reduced to levels specified by the WQCB. Prior to abandonment, these cyanide levels will be verified by a program of grid drilling.

Summary of Proposed Monitoring Activities

In order to comply with certain regulatory requirements and ensure that unanticipated impacts are identified, AGMJV is proposing to continue a variety of monitoring and data collection efforts. These efforts are summarized in Table 9.

ALTERNATIVE 1
NO ACTION

This alternative means the continuation of existing management for the project area without approval of the proposed action. The general mining law allows, as a right, development of mineral resources on public land subject to the operation of the law. This right was amended with the passage of the Federal Land Policy and Management Act of 1976. Under terms of the law, BLM is mandated to disapprove a plan of operation if a finding of unnecessary and undue degradation is made.

TABLE 9

PROPOSED ORO CRUZ MONITORING AND DATA COLLECTION ACTIVITIES

Monitoring Category	Type	Frequency	Regulatory Agency
Geotechnical	• slope stability • surface subsidence	• ongoing • ongoing	None
Water Quality	• freeboard • monitoring well • LCRS	• quarterly • monthly • monthly	Regional Water Quality Control Board
Water Consumption	• annual consumption • well drawdown	• annually • annually	Imperial County Planning Department
Air Quality	• PM10 • HCN • % sulfur • fuel consumption	• quarterly/ annually • quarterly • quarterly • quarterly	Air Pollution Control Board
Wildlife	• wildlife mortalities • threatened and endangered species	• monthly • ongoing	Bureau of Land Management
Vegetation	• test plots	• annually	Bureau of Land Management Imperial County Planning Department

NOTE: All monitoring and data collection activities would be conducted by AGMJV or its consultants. Monitoring results would be provided to the listed regulatory agencies.

ALTERNATIVE 2
COMPLETE BACKFILLING OF WASTE ROCK

The applicant has proposed partial backfilling of Oro Cruz waste rock, with backfilling of waste rock into the proposed Queen pit. This alternative would require complete backfilling of waste rock into Oro Cruz and American Girl Canyon pits so that there is no surface disposal of Oro Cruz waste rock.

The Cross pit would not accommodate all of the remaining Oro Cruz waste. Therefore, in order to accomplish complete backfilling, waste would have to be hauled to American Girl Canyon pits in addition to the Oro Cruz Cross pit. Complete backfilling would involve loading and hauling 4.4 million tons of waste rock from the Oro Cruz waste dump to the Cross pit (a distance of 0.4 miles) with the remaining 3.0 million tons hauled to American Girl Canyon for disposal (2.9 miles).

ALTERNATIVE 3
CYANIDE SOLUTION APPLICATION VIA DRIP EMITTERS

Heap leaching of gold ore is a process by which a gold-dissolving solution (dilute sodium cyanide) is percolated through the ore piled onto the lined heap

leach pad. The Oro Cruz operation POO proposes the use of the existing heap leach at American Girl Canyon. Original American Girl Canyon operating plans called for cyanide solution applications on the heap leach via drip emitters as used in the Padre Madre heap leach facility. When the mill in American Girl Canyon became operational in 1990, the operation began experiencing excessive accumulations of water in the barren pond which receives solution discharged from the carbon plant circuit. The immediate response to this water problem was to implement the use of evaporative spray (impact) sprinklers for cyanide solution application. AGMJV has proposed the continued use of impact sprinkler application at American Girl Canyon for Oro Cruz ore. Because of the original permit terms, potential for reducing the use of water and the potential for reducing possible exposure of wildlife to adverse effects from cyanide, the use of drip application is analyzed in this EIS as Alternative 3.

Drip emitters used on heap leaches can be equated with agricultural drip irrigation systems. The actual pressure emitter mechanisms would be turbulent flow devices which attach in-line through a network of polyvinylchloride (PVC) piping to provide even solution distribution. Spacing of emitters would be determined to achieve the proper wetting action based on case-specific circumstances. Emitters work on the principle that water droplets work their way through a tortuous route, losing pressure, and drip out at a fairly slow rate. The ore heap would be wetted laterally and vertically by capillary action (Muhtadi, 1988).

ALTERNATIVE 4
FLOATING COVER ON PONDS CONTAINING CYANIDE SOLUTION

The heap leach facilities for the Oro Cruz gold recovery operation at the existing American Girl Canyon consist of the lined pad and two double-lined solution ponds (the barren pond and the pregnant pond). The barren and pregnant solution ponds are part of an overall closed circuit, zero discharge facility with full leakage detection systems in place. With current operations at American Girl Canyon and Padre Madre, netting is used as the primary tool to restrict access to cyanide solutions. AGMJV has proposed to continue use of netting at American Girl Canyon during Oro Cruz processing operations. The utilization of a floating cover on American Girl Canyon open ponds to prevent exposure of wildlife to cyanide solutions rather than netting is considered in this EIS as Alternative 4.

A floating cover would be made of very low density polyethylene (VLDPE). Pieces of this material would be welded together to form a continuous cover over the solution ponds. The cover would be sized to the maximum potential pond height so that solution would be covered at all times. When pond levels would be below maximum, the cover would float downward with the pond. The cover would be attached to the ground by an anchor trench.

BLM'S PREFERRED ALTERNATIVE

Based on the results of environmental analysis as documented within this EIS, BLM has identified its preferred alternative for mining and processing Oro Cruz ore. The Preferred Alternative is a combination of the Oro Cruz operation as proposed by AGMJV and Alternative 3 -- Cyanide Solution Application via Drip Emitters. The preferred alternative would allow mining and processing of Oro Cruz ore as proposed by AGMJV, but would require drip cyanide solution application. Use of impact sprinklers under specific circumstances would be authorized on side slope portions of the heap to allow AGMJV to maintain operational control of pond levels, chemistry and metallurgy. Conditions under which AGMJV would be allowed to return to sprinkler application of cyanide solution involve significant events of:

- *rainfall amounts which jeopardize pond capacities,*
- *reduction in filtration efficiency causing a major increase in soluble gold loss,*
- *reduction in filtration efficiency causing a major increase in moisture content,*
- *increases in copper content within heap leach or mill pregnant solutions causing a chemical imbalance jeopardizing process efficiency and effectiveness.*

These conditions are described in more detail in Chapter 4.

During heap leach detoxification and decommissioning, use of sprinklers would be allowed in accordance with the American Girl Project Closure and Post-Closure Plan (e.g., recirculation of fresh rinse water only). The spraying action from sprinklers promotes ultraviolet-induced cyanide decomposition and oxidation of the cyanide complex as a part of the detoxification process.

ALTERNATIVES ELIMINATED FROM FURTHER STUDY

All alternatives were evaluated in terms of technical and economic feasibility, the magnitude and scope of potential environmental impacts, and overall reasonableness. Some alternatives, as described and discussed below, were eliminated from detailed NEPA analysis for these reasons.

Changes in Mining and Processing Operations

The Oro Cruz POO proposes both surface and underground mining and gold recovery processing using both milling and heap leaching techniques. These mining and processing procedures and techniques are proposed by AGMJV to fit the location, extent, physical character, and economic character of the mineralized area.

AGMJV considered alternatives for mining and processing techniques throughout the planning and feasibility stages of the project. Based on all available information, recovery of gold from the Oro Cruz mineralization is best accomplished by both underground and surface mining, and by both heap leach and mill processing. Exclusive use of one mining approach (e.g., underground mining alone or

surface mining alone), or exclusive use of one processing approach (e.g., heap leaching alone or milling alone) does not fulfill the purpose of and need for the proposed action by AGMJV.

Different rates of mining and processing were also evaluated by AGMJV. After careful economic evaluation, the proposed project production rate and size were judged to be the most feasible option by AGMJV. It is also not economically feasible to process ore at a site other than the American Girl Project. Therefore, potential alternatives to the type and rate of mining and processing have been eliminated from further consideration within this EIS.

Changes in the Location of Project Facilities and Components

Major proposed operational components and facilities associated with the Oro Cruz operation include open pits, underground mine components, waste rock dumps, the existing heap leach and mill (at the American Girl Canyon operation), and a haul/access road to the American Girl Canyon operation. The rationale for eliminating alternatives to proposed locations of these facilities is discussed below.

Surface and Underground Mining Locations. The location of the Oro Cruz gold deposit is fixed. Locations of the open pits and underground mining components cannot be altered without making the project logistically unfeasible and uneconomic. Pit designs and underground mine components were designed to be as efficient as possible. Therefore, alternatives to the proposed locations of open pits and underground mine components have been eliminated from further consideration within this EIS.

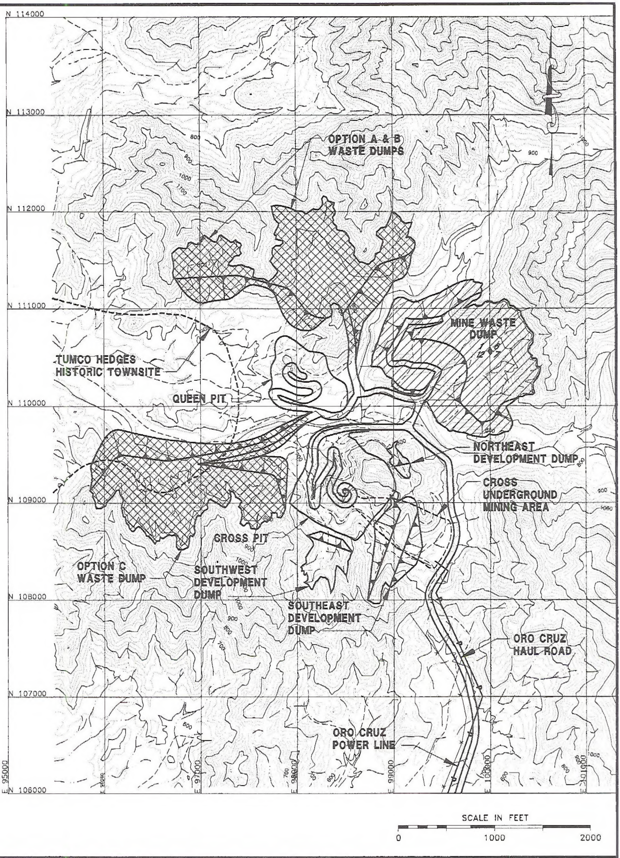
Waste Rock Dump Location. Three alternative waste dump sites (A/B, C and D) were evaluated by AGMJV to determine the site most favorable for the bulk of Oro Cruz waste rock. The three sites were initially selected to avoid the major washes (and 100 year floodplain areas) in the Tumco Wash basin. These sites are shown in Figure 14. Because each site contained adequate volume for the waste rock, a selection process was initiated to determine the most suitable site. Criteria used in the selection process were as follows:

- Economics - *The most favorable site would be well placed relative to the mine sites to provide the shortest waste haul with the lowest maximum vertical height.*

- Favorability for Mineralization - *A condemnation drilling program was conducted in 1992 to ensure the selected waste dump would not be sited over an area that could contain economic mineralization.*

- Impact to Wildlife Resources - *The potential dump sites were evaluated based on relative impacts to wildlife resources, with particular emphasis on the desert tortoise.*

- Impact to Cultural Resources - *In 1992, a cultural resource study was conducted for the Hedges/Tumco townsite to determine eligibility for the National Register of Historic Places. The dump sites were located to generally avoid areas of any significant cultural resources.*



PROPOSED WASTE ROCK DUMP SITE

OPTIONAL SITES A, B, & C
(ELIMINATED FROM CONSIDERATION)

FIGURE 14

OPTIONAL WASTE DUMP SITES FOR
ORO CRUZ OPERATION

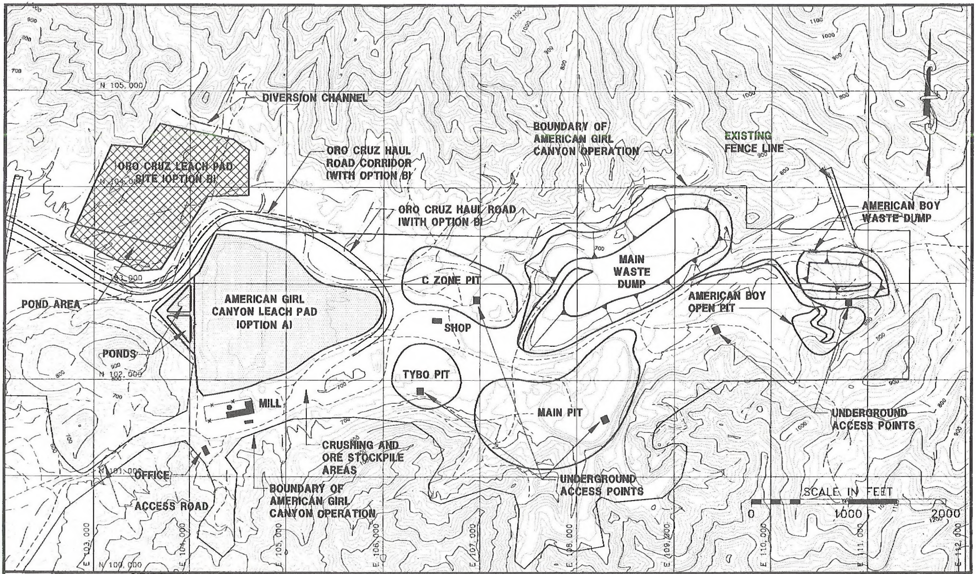
- *Visual Impact - The ideal site would have minimal visual impact; particularly from Ogilby Road, west of the project area.*

Site C, located immediately west of the Cross pit, was eliminated from consideration based on several of the criteria noted above. With regard to wildlife, it was found that although the direct loss of tortoise habitat due to disturbance is virtually equivalent between the three sites, the site C option resulted in greater indirect loss of habitat through perimeter fencing. Choosing the site C option would require locating a tortoise-proof security fence further west in Tumco Valley and would result in the increased loss of tortoise habitat for the life of the project. Moreover, site C would result in the permanent loss of the Crown mine portal, an existing maternity roost for California leaf-nosed bats which will become increasingly important with the loss of the Queen mine habitat. Based on preliminary results from the Hedges/Tumco cultural resource study, it was found that a number of important cultural resources occur in the site C dump area. This information also indicated that site A/B could also conflict with cultural resources in the southern portion of the dump area. Site D is outside the Hedges/Tumco townsite per se and lacks significant cultural resources.

In addition to the lesser environmental impacts described above, Site D has a higher level of existing disturbance from past mining and exploration activities and shows slightly favorable economics relative to Site A/B. Consequently, Site D was chosen for a condemnation drill program. The program was completed in mid-1992, with no significant mineralization being encountered. Therefore, site D, northeast of the Cross pit, was designated by AGMJV as the proposed Oro Cruz waste dump site, based on the above criteria. There are no reasonable alternatives to the proposed location of the Oro Cruz waste rock dump which meet the need for the proposed action and lessen environmental impacts relative to site D.

Processing Facilities Locations. The Oro Cruz POO proposes to have Oro Cruz ore processed using existing heap leach and mill facilities at the American Girl Canyon operation. The ore is amenable to both types of processing. At an early planning stage, AGMJV determined that it was uneconomical to build new mill facilities at Oro Cruz. The use of the existing American Girl Canyon heap leach pad for Oro Cruz ore was selected from several options for leaching. Other options for leaching included constructing a new leach pad in Tumco Wash or north of American Girl Canyon Wash. The optional leach pad sites in Tumco Wash conflicted with cultural resources or with the proposed waste dump site. The optional leach pad site north of American Girl Canyon Wash is shown in Figure 15. This optional site was logistically acceptable, but once it was determined by AGMJV that the existing leach pad could physically handle the Oro Cruz ore, the alternative site was dropped from consideration to minimize or eliminate surface disturbance, thereby avoiding unnecessary and undue degradation of Federal lands. Therefore, alternatives to the proposed use of existing processing facilities have been eliminated from further consideration within this EIS.

Haul Road to American Girl Canyon Location. A haul road to the existing American Girl Canyon operation facilities is proposed in order to move equipment to and from the Oro Cruz site and to haul ore to the existing mill and heap leach at American



EXISTING LEACH PAD (PROPOSED ACTION)

OPTIONAL NEW HEAP LEACH PAD (ELIMINATED FROM CONSIDERATION)

KEY

1		
2	3	
	4	

FIGURE 15

OPTIONAL LEACH PAD SITES FOR ORO CRUZ OPERATION

Girl Canyon. An alternative haul route to American Girl Canyon using Ogilby Road (County Highway S34) was considered. Travel times to American Girl Canyon from Oro Cruz would be lengthened considerably if Ogilby Road was used as the principle haul route. Additionally, there would be potentially dangerous interaction with passenger vehicles if Ogilby Road were used, and the Oro Cruz truck traffic would not meet minimum highway requirements. Therefore, this alternative haul route has been eliminated from further consideration within this EIS.

Change in the Source of Electrical Power

Power requirements at Oro Cruz would be minimal. The POO proposes electrical power generation using the American Girl Canyon Generating Facility (with an overhead transmission line to Oro Cruz). Other power supply options (such as tapping into existing lines from either the Imperial Irrigation District or the Western Area Power Administration) have been previously analyzed by AGMJV in association with development of the two currently operating components of the American Girl Project. These alternatives would require 15-20 miles of powerline construction, and would have a major visual impact, and were therefore eliminated from further consideration in this EIS.

Change in the Source of Water

Water for the Oro Cruz operation would initially be provided from flooded underground workings. The water would be pumped to a 50,000 gallon storage tank. When this dewatering program is no longer capable of supplying water, a water line would be installed along the Oro Cruz access road using existing wells. The AGMJV is permitted to use up to 484 acre-ft per year from wells. After three years of operation at Padre Madre and American Girl Canyon, there is no measurable effect to the water table level. There are no viable cost-effective alternatives for Oro Cruz water supply.

EXISTING CONDITIONS AND REASONABLY FORESEEABLE ACTIVITIES AFFECTING THE CUMULATIVE ENVIRONMENT

Other past, present or future activities occurring in the vicinity of the Oro Cruz area have the potential for creating cumulative environmental impacts. In other words, certain activities may directly contribute positive or negative environmental impacts which, when considered in conjunction with impacts potentially created by implementation of the Oro Cruz operation, lessen or increase the overall impact upon the environment. The purpose of this section is to identify and discuss those activities which need to be considered for cumulative impacts analysis, and to provide the rationale as to how those activities relate to the existing environment.

Past, present and future activities within or adjacent to the proposed Oro Cruz site which were evaluated for their potential creation of cumulative impacts include the following:

- ***Current AGMJV Mining Activities.*** *The existing American Girl Project consists of the Padre Madre and American Girl Canyon operations, which are located south of the*

proposed Oro Cruz operation. As discussed in Chapter 1 of this EIS, the cumulative effects of the entire project are a major issue within the EIS process. As shown in Table 10, the Oro Cruz operation would disturb an additional 191 acres, bringing the cumulative projected disturbance for the entire American Girl Project to an estimated 809 acres. Oro Cruz development would extend the life of the American Girl Project an additional 2 years beyond current plans for the existing Padre Madre and American Girl Canyon operations. If approved, Oro Cruz would account for 73 percent of total surface ore tons produced by the project after 1992, and for 52 percent of total underground ore tons after 1992 (see Table 11). The cumulative effects of Oro Cruz development as the third operating component of the American Girl Project is an integral part of this EIS.

- ***Historic Mining-Related Disturbances.*** *The American Girl Project vicinity is an area of historic mining activity. Evidence of surface prospecting and remnants of historical mining and ore processing facilities is abundant in the area. These disturbances have become a part of the existing environment, and will be considered in both the direct impacts associated with Oro Cruz and with the cumulative impacts within the American Girl Project area as a whole.*

- ***Recent Disturbance from Oro Cruz Exploration.*** *AGMJV has disturbed approximately 6 acres in the Oro Cruz area through its recent exploration activities to evaluate ore reserves and potential facilities locations. Major types of disturbances include roads and exploration drill holes. These activities, approved by BLM through exploration permits, are minor in scope compared to the more extensive historic disturbances. BLM permit requirements ensure that the recent exploration disturbances will be reclaimed with or without full Oro Cruz development. The disturbances are a part of the current existing environment and are discussed in Chapter 3 of this EIS.*

- ***Recreation Activities.*** *Primarily because of the historic mining activities (e.g., the Hedges/Tumco historic townsite) in the area, the American Girl Project vicinity is of interest to recreationalists who have traditionally used the area for sightseeing, off-road vehicle use, rock hounding and camping. This recreational use has been and currently is regulated through the 1980 California Desert Conservation Area Plan. Recreation opportunities and the public safety of recreationalists is an important issue within this EIS, and will be considered in both the direct impacts of Oro Cruz and the cumulative impacts within the American Girl Project area as a whole.*

- ***Future Mining Activities.*** *extent of future potential mining development of other unidentified areas in the Cargo Muchacho Mountains is tied to the market value of gold. It is unknown if any additional areas will be developed in the future and what the resulting individual and cumulative impacts would be. The distribution of historic mines in these mountains suggests that there are opportunities*

TABLE 10

SUMMARY OF THE CUMULATIVE DIRECT IMPACT AREA AMERICAN GIRL PROJECT

		Acreage
Environmental Study Area	American Girl/Padre Madre/Oro Cruz	2,100 4,300 6,400
American Girl Canyon Operation	Area of Direct Impact	379
Padre Madre Operation	Area of Direct Impact	239
Oro Cruz Operation	Oro Cruz Facilities Haul Road Aggregate Pit Subtotal	 101 50 40 191
American Girl Project	Cumulative Area of Direct Impact	809

TABLE 11

PROJECTED FUTURE PRODUCTION FROM AMERICAN GIRL PROJECT
(by operation and type of mining)

	1993	1994	1995	1996	1997	TOTALS
PADRE MADRE SURFACE						
Ore Tons	99,000	0	0	0	0	99,000
Waste Tons	591,000	0	0	0	0	591,000
AGC SURFACE						
Ore Tons	683,000	0	0	0	0	683,000
Waste Tons	1,194,000	0	0	0	0	1,194,000
ORO CRUZ SURFACE						
Ore Tons	0	732,000	976,000	750,000	0	2,458,000
Waste Tons	0	3,468,000	3,291,000	1,700,000	0	8,459,000
AGC UNDERGROUND						
Ore Tons	233,900	233,900	0	0	0	466,900
Waste Tons	48,300	0	0	0	0	48,300
ORO CRUZ UNDERGROUND						
Ore Tons	0	0	225,000	250,000	25,000	500,000
Waste Tons	0	40,000	25,000	0	0	65,000

Note: AGC = American Girl Canyon

for additional mining if supported by higher gold prices. However, any estimation of future development, if any, would be highly speculative based on current information. Future mining development proposed by AGMJV or any other entity is not considered a "reasonably foreseeable activity". Future potential mining activity is, therefore, beyond the scope of this EIS.

In addition to the above activites within or adjacent to the location of the proposed action, other more regional projects are considered in the cumulative impact analysis within Chapter 5 of this EIS.

CHAPTER 3
EXISTING ENVIRONMENT

The Oro Cruz operation of the American Girl Project is proposed for a relatively remote area of southeastern California in Imperial County. The operation area is situated on the western edge of the Cargo Muchacho Mountains. Vegetation is sparse, with high temperatures and low precipitation restricting land and resource uses. The vast majority of land is open space. Historically, the American Girl Project area has been principally used for mining and prospecting. There are numerous historic gold mines or prospects in the Cargo Muchacho Mountains, some of which were major gold producers. In addition to the gold mineralization, the area also has uranium, geothermal, mica, and kyanite (aluminum silicate) resources. There is a considerable amount of surface disturbance as a result of past mining activity. These historic disturbances are an important feature of the existing environment. The relationship of the proposed Oro Cruz area to historic and recent disturbances is shown in Figures 16 and 17.

As discussed in Chapter 1, the scope of this EIS includes the direct effects from Oro Cruz development and the cumulative effects from the entire American Girl Project (Oro Cruz, Padre Madre and American Girl Canyon operations). Padre Madre and American Girl Canyon operations have been previously approved by BLM and are a part of the existing environment. The Padre Madre and American Girl Canyon operations are summarized in Chapter 2. The proposed Oro Cruz operation would use existing processing facilities (heap leach and mill) at American Girl Canyon.

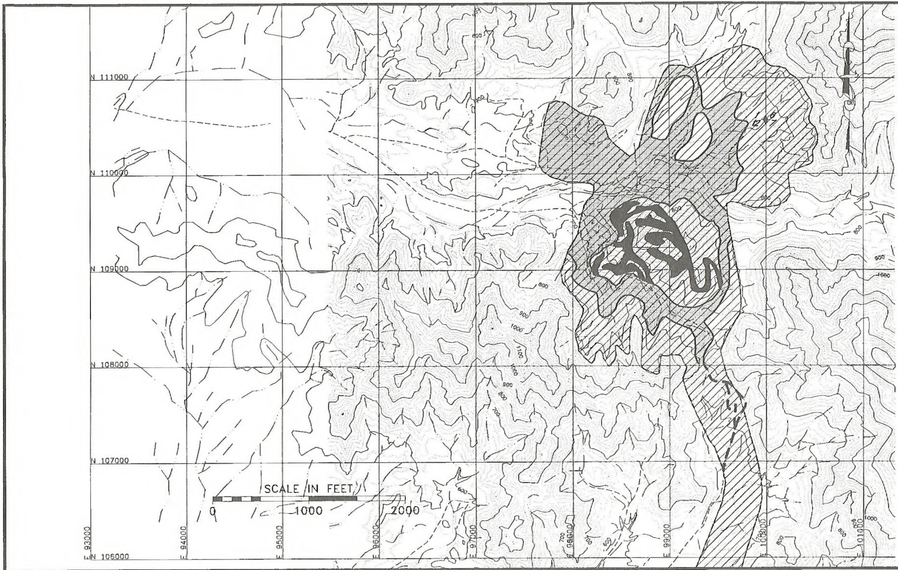
The study area for this EIS is the entire American Girl Project area. Because the existing environment for the Padre Madre and American Girl Canyon operations have been described in previous BLM environmental analyses (see below), and because Oro Cruz is the operation currently being proposed to BLM and other regulatory agencies, the focus of this EIS is the Oro Cruz disturbance area. Where there is no site-specific distinction between the Oro Cruz area and the other existing operation areas, discussions in this Chapter describe conditions within the American Girl Project area (containing the Padre Madre, American Girl Canyon and Oro Cruz operation sites) as a whole.

The major sources of available data describing the environmental conditions in the American Girl Project vicinity include environmental analyses describing the existing (permitted) operations:

- *an Environmental Assessment on the proposed Padre Madre operations, prepared by the BLM in September, 1987 (BLM, 1987);*

- *an Environmental Assessment /Environmental Impact Report on the proposed American Girl Canyon operations, prepared by the BLM and Imperial County in November 1988 (BLM and Imperial County, 1988);*

- *a Biological Assessment on American Girl Canyon Expansion, prepared by BLM for the*



LEGEND – DISTURBANCE AREA

HISTORIC DISTURBANCE AREA

RECENT DISTURBANCE AREA

RECENT DISTURBANCE AREA (ROADS)

ORO CRUZ OPERATION AND HAUL ROAD CORRIDOR

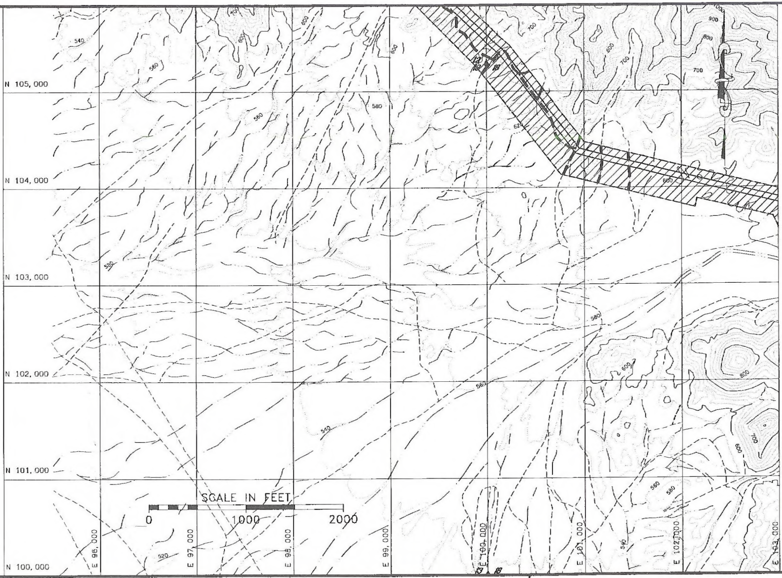
KEY

1

2

FIGURE 16

DISTURBANCE MAP – UPPER ORO CRUZ CORRIDOR



RECENT DISTURBANCE AREA (ROADS)

ORO CRUZ HAUL
ROAD CORRIDOR

KEY

1

2

FIGURE 17

DISTURBANCE MAP -
MIDDLE ORO CRUZ CORRIDOR

U.S. Fish and Wildlife Service in 1992 under Section 7 of the Endangered Species Act of 1978 (BLM, 1993).

These documents are available for review at the BLM office in El Centro, California.

Information on the existing environment from the above documents is used throughout this Chapter. Additionally, surveys describing soil, vegetation, wildlife, cultural, and visual resources of the Oro Cruz area have been conducted to supplement existing data.

Subsections of this chapter provide summary information obtained from existing documents and site-specific surveys. Elements of the human environment discussed include:

- *Climate and Air Quality*
- *Geology*
- *Hydrology*
- *Soils*
- *Vegetation*
- *Wildlife*
- *Land Use*
- *Recreation*
- *Visual Resources*
- *Sound*
- *Cultural Resources*
- *Transportation*
- *Socioeconomics*

Issues including cyanide management and reclamation are addressed as they relate to specific elements of the human environment (e.g. wildlife). Elements of the human environment such as Areas of Critical Environmental Concern, Farmlands, Wetlands, Wild and Scenic Rivers and Wilderness do not exist in the project vicinity, would not be affected, and are therefore not discussed in the EIS.

CLIMATE AND AIR QUALITY

The climate of the American Girl Project area is marked by low precipitation, arid winds, and high temperatures. The area experiences a high percentage of sunshine. The period from late fall through early spring generally has moderate daytime temperatures and cool nights. The annual precipitation of about 3 inches is evenly distributed throughout the year, except in the dry months of May and June. Mountain ranges to the north and west prevent the movement of cold continental air masses into the area in winter and prevent the influence of cooler Pacific air in the summer.

The Los Angeles air basin (250 miles to the northwest), the Imperial Sand Dunes (10 miles to the west), and Imperial Valley agriculture (15 miles to the west) are likely distant contributors to on-site pollution. Vehicle emissions from Los Angeles may add to ozone problems in the American Girl Project air basin. Arid climate conditions create an environment that is prone to extensive wind erosion at the Dunes and on agricultural lands in the Imperial Valley. This may contribute significantly to air-borne particulates in the region.

Climate

Distinguishing Characteristics of the Region. In the summer, regional climatic conditions are influenced by a significant thermal low-pressure system which develops over the hot desert area. The system strengthens enough to create a strong sea

breeze off the nearby Gulf of California. During the hot summer months, these winds from the south and southeast prevail. Intense thunderstorms occasionally develop in late summer and can bring significant amounts of rainfall in a short period of time resulting in flash flooding. This moisture results from a monsoon-like circulation pattern in August and September, which brings moisture up from the Gulf of Mexico and the Gulf of California. Winds prevail from the northeast in the winter months and from the north to west-northwest in the spring months. Data from the U.S. Navy Weather Service, presented in Table 12, summarize climate parameters for three nearby weather stations: Yuma, El Centro, and Blythe.

Project Monitoring Stations. In association with development of the Padre Madre and American Girl Canyon operations, an air quality/dispersion climatology monitoring program was initiated by AGMJV in January 1988 and has continued since that time. Air quality instruments are calibrated quarterly and meteorological instruments are calibrated semi-annually. Monitoring protocol was approved by the Imperial County Air Pollution Control District (APCD).

The primary monitoring site is located 1,170 yards south of the Padre Madre entrance gate (elevation: 500 ft. MSL; UTM coordinates: 705.5 km E, 3,635.7 km N). At this 10-meter tower station, temperature, precipitation, wind speed, wind direction, and wind direction deviation are measured. In the following discussions of on-site meteorologic conditions, long-term data (1920-1989) for Yuma, Arizona (Earthinfo Inc., 1989) are used to demonstrate the representativeness of on-site data for the area.

Temperature. The average annual recorded temperatures are 24.5°C (75.2°F) on site and 22.1°C (71.8°F) at Yuma. The highest monthly average of daily maximum temperatures is 41.1°C (106°F) occurring in the month of July at both the project site and at Yuma. The lowest monthly average of daily minimum temperature is 7.7°C (46°F) occurring in December at the project site, and 3.9°C (39°F) occurring in January at Yuma.

Precipitation. Table 13 presents monthly average precipitation for the project area and for the Yuma Station. The average annual on-site precipitation total over this period was 2.14 inches, as compared to 3.41 inches for Yuma. No snowfall was recorded over this time period for the Yuma Station. Snowfall was not monitored at the Padre Madre Station.

Evaporation. For the Yuma Station, the annual total evaporation is 97.66 inches with the greatest evaporation occurring May through August (approximately 50 percent). No evaporation data were collected on site. The Yuma data represents the evaporative pattern in the whole region due to the similarity of climatology.

Severe Storm and Precipitation Extremes. Table 14 presents the 10, 25, 50, and 100-year expected maximum six-hour, and 24-hour rainfall events. The maximum precipitation extreme data do not indicate large amounts of precipitation; however, the data show that a typical year's worth of precipitation can occur in a single one-day event.

TABLE 12

SELECTED AREA METEOROLOGICAL DATA

Parameter	Yuma	El Centro	Blythe
Elevation (ft)	213	-43	397
Avg. annual temperature (°F)	73	74	74
July max. temperature (°F)	106	107	108
January min. temperature (°F)	42	43	41
Days per year >89°F	188	174	178
Days per year <32°F	2	3	6
Mean relative humidity (%)	44	38	36
Annual rainfall (inches)	3.5	1.8	3.2
Days per year >0.1 in. rain	12	5	12
Thunderstorm days per year	10	4	9
Winds >20 mph (%)	3.0	8.9	6.0
Winds >32 mph (%)	0.0	0.6	0.4
Annual evaporation (inches)	99.9	116.9	118.9

Source: U.S. Navy Weather Service, 1969.

TABLE 13

MONTHLY PRECIPITATION AVERAGES FOR PADRE MADRE AND YUMA (inches)

	Padre Madre						Yuma
	1989	1990	1991	1992	1993	Avg.	Sept. 1920 - Dec. 1989 Avg.
Jan	0.69	0.34	0.46	0.49	0.00	0.40	0.38
Feb	0.00	0.00	0.33	0.87	1.45	0.53	0.30
Mar	0.04	0.02	0.67	1.22	0.41	0.47	0.26
Apr	0.00	0.02	0.00	0.25	0.00	0.05	0.13
May	0.00	0.09	0.00	0.16	0.01	0.05	0.02
Jun	0.00	0.04	0.00	0.00	0.00	0.01	0.02
Jul	0.65	0.25	0.00	0.00	0.00	0.18	0.26
Aug	0.07	0.35	0.06	3.08	0.03	0.72	0.60
Sep	0.00	0.13	0.62	0.00	0.01	0.15	0.42
Oct	0.00	0.28	0.40	0.05	---	0.18	0.36
Nov	0.00	0.00	0.16	0.00	---	0.04	0.19
Dec	0.00	0.01	0.36	1.04	---	0.35	0.47
Total						3.13	3.41

Source: Air Sciences, 1993 and Earthinfo, Inc.,1989.

TABLE 14

RANGES FOR 10, 25, 50 and 100-YEAR PRECIPITATION EVENTS
FOR 6-HOUR and 24-HOUR PERIODS

	6-Hour (in)	24-Hour (in)
10-Year	1.6 - 1.8	2.0 - 2.5
25-Year	2.2 - 2.4	2.5 - 3.0
50-Year	2.5 - 3.0	3.0 - 3.5
100-year	2.75 - 3.0	3.5 - 4.0

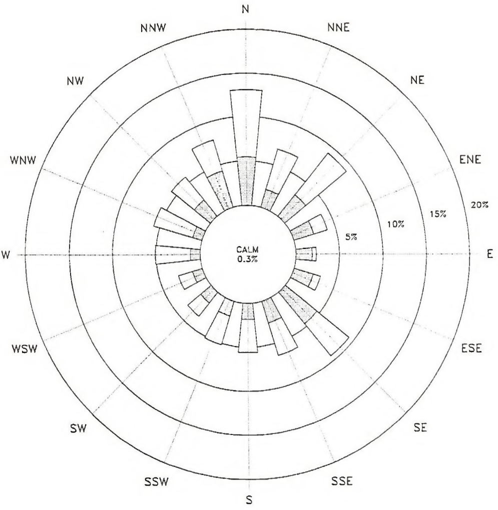
Source: NOAA, 1973.

Growing Season. The Oro Cruz site is located in the Cargo Muchacho Mountains, an arid region with scant vegetation. Based on 30-year climatological data for Yuma from 1951 through 1980 (NOAA, 1985), temperature extreme data indicate that it is possible for the temperature to drop below the freezing point (32°F) in the months of November through February, potentially limiting the growing season. The number of average annual heating degree days (below base 65°F) for these 30-year data is 983 and the number of average annual cooling degree days (above base 65°F) is 4,244.

Winds. Wind information was recorded on-site from January 1988 to present. This data set has been collected over a sufficiently long period of time to be representative of the long-term wind patterns on the project site and in the region. The wind speed and direction data are presented graphically in Figure 18 as a wind rose. The mean wind speed is 6.8 knots (kt) (3.5 meters per second (m/s)) with the winds predominating from the north-northwest to northeast directions. These predominating winds account for 37.9 percent of the total winds with average speeds of 7.2 kt (3.7 m/s). A secondary wind peak from the southeast accounts for 9.4 percent of the winds with average speeds of 6.2 kt (3.2 m/s). Figure 19 presents a series of four wind roses that show the seasonal changes of wind patterns. In the spring (March through May), winds are mostly from the west to north, while the southeast to south-southwest directions dominate during the summer months (June through August). In the fall (September through November) and winter (December through February), winds blow mostly from the north to northeast directions.

Wind Stability. Stability, a measure of turbulence, is related to solar radiation, wind speed and wind direction. Stable, less turbulent winds have poorer pollutant dispersion potential. For this operational site, stable wind conditions occur approximately 20% of the time and are predominantly from the NNW to ENE. High stability conditions are likely to occur during night-time hours.

Dispersion Conditions. Wind speed, direction and stability affect how pollutants disperse. Most importantly, dispersion is directly related to wind speed. Doubling the speed doubles dispersion potential (halves the pollutant concentration). At the American Girl Project site, winds from the east-



AVERAGE WIND SPEED = 6.8 KNOTS

LEGEND

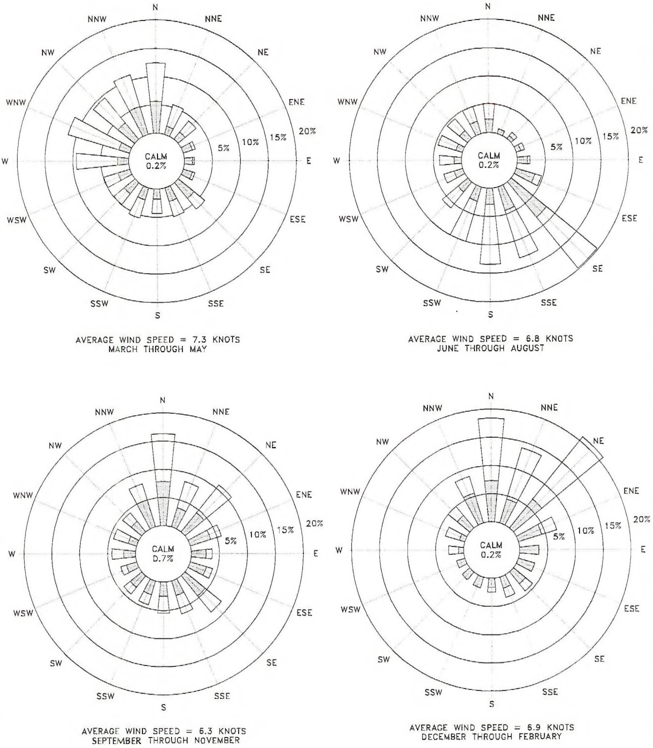
< 6 KNOTS

≥ 6 KNOTS

CALMS ARE WINDS WITH SPEEDS LESS THAN 1 KNOT

FIGURE 18

WIND FREQUENCY DISTRIBUTION



LEGEND

< 6 KNOTS

≥ 6 KNOTS

CALMS ARE WINDS WITH SPEEDS LESS THAN 1 KNOT

FIGURE 19

WIND FREQUENCY DISTRIBUTION BY SEASON

northeast to east-southeast are associated with lower average speeds. These low speed winds provide the least favorable conditions for dispersion of pollutants in the project area. Of secondary importance, the stable wind data summarized above indicate the potential for surface-level emissions to be concentrated SSE to WSW of the project site.

Air Quality

Imperial County is located in the Southeast Desert air basin, east of the Los Angeles air basin. As previously mentioned, the city of Los Angeles, the local sand dunes, and Imperial Valley agriculture are expected to contribute significantly to pollutants in the project area region. Mining is the major project area activity. It is anticipated that emissions of dust from mining activities will be the primary emission of concern and may contribute to off-site ambient concentrations of particulate matter. The cities of Yuma (15 miles southeast) and El Centro (40 miles west) are both relatively small cities without significant industrial process sources, and are not expected to contribute significantly to ambient pollution levels near the project site.

Air quality is frequently evaluated in terms of concentrations of the six federally defined criteria pollutants. These criteria pollutants are respirable particulate matter (i.e. that which is less than 10 microns in aerodynamic diameter, referred to as PM_{10}), sulfur oxides (SO_x), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), and lead (Pb). Maximum allowable ambient concentrations of these pollutants have been defined by the EPA (known as National Ambient Air Quality Standards, or NAAQS), the State of California, and Imperial County. A summary of these standards is presented in Table 15. In addition, California's 1-hour standard for hydrogen sulfide (H_2S) is presented. These standards are health-based and states and/or local government agencies are required to implement federally enforceable programs that maintain ambient levels below the standards (in areas where the standards have not been exceeded) or to decrease emissions from sources in order to attain the standards (in areas where the standards have been exceeded).

Project Monitoring Station. Air quality monitoring for the project includes PM_{10} particulate samplers installed at both the Padre Madre site (as previously described) and at Gold Rock Ranch (elevation: 480 ft. MSL; UTM coordinates: 700.1 km E, 3,639.8 km N), about 3 miles west of the Oro Cruz area. The Gold Rock Ranch monitoring site is not within the American Girl project boundaries; monitoring at this site was intended to indicate local background conditions, while the Padre Madre site was intended to indicate project impacts. These samplers measure ambient concentrations in micrograms per cubic meter ($\mu g/m^3$) of PM_{10}.

The PM_{10} monitoring program began in January 1988 and has continued since that time. Two samplers were located at the Gold Rock Ranch site for the first six months to verify precision and to establish baseline. One PM_{10} sampler was then moved to the Padre Madre site, where monitoring has continued since July of 1988. At the Gold Rock Ranch site, monitoring was suspended one year after commencement. The station was re-started in October 1990 and has continuously run since that time. PM_{10} samples are collected every six days at each sampler.

TABLE 15

NATIONAL AND LOCAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Period	National Standards	California Standards
PM_{10}	24-hour	150 $\mu g/m^3$ (1)	50 $\mu g/m^3$ (3)
	annual	50 $\mu g/m^3$ (1)	30 $\mu g/m^3$ (3)
Sulfur oxides	1-hour	---	655 $\mu g/m^3$ (3)
	3-hour	1,300 $\mu g/m^3$ (2)	---
	24-hour	365 $\mu g/m^3$ (2)	105 $\mu g/m^3$ (3)
	annual	80 $\mu g/m^3$	---
Nitrogen dioxide	1-hour	---	470 $\mu g/m^3$ (3)
	annual	100 $\mu g/m^3$	---
Carbon monoxide	1-hour	40 mg/m^3 (2)	23 mg/m^3 (3)
	8-hour	10 mg/m^3 (2)	10 mg/m^3 (3)
Ozone	1-hour	235 $\mu g/m^3$ (2)	180 $\mu g/m^3$ (3)
Lead	30-day	---	1.5 $\mu g/m^3$ (4)
	quarter	1.5 $\mu g/m^3$	---
Hydrogen sulfide	1-hour	---	42 $\mu g/m^3$ (4)

(1) Not to exceed an average of once per year over three or more representative years of data.
(2) Not to be exceeded more than once per year.
(3) Not to be exceeded.
(4) Not to be equaled or exceeded.

Source: 40 CFR 50.4-12 and California Air Resources Board Facts Sheet 38

Air Basin Attainment Status. Ozone levels in Imperial County exceed the federal and state standards. It is likely that these exceedances are largely due to automobile emissions transported from the Los Angeles basin to the air basin of the project area. Therefore, the EPA has designated the entire county as an ozone non-attainment area. The non-attainment area status of Imperial County may have permitting implications for the Oro Cruz operation as both volatile organic compounds (resulting from on-site storage, dispensing and combustion of fuel) and oxides of nitrogen (resulting from fuel combustion in stationary and mobile sources) will be emitted. These pollutants are principal precursors to ozone formation.

Imperial County is also designated by the state as non-attainment for particulates. Local sources of particulates include the nearby sand dunes and agriculture.

Particulate emissions are expected to be the primary air quality concern for the Oro Cruz operation. Imperial County has not been designated non-attainment for any other criteria pollutants.

Prevention of Significant Deterioration Classification. The EPA has established a classification system for the prevention of significant deterioration (PSD) of air quality. This system applies to areas in attainment of the NAAQS. Areas are categorized as Class I, Class II, or Class III. Class I areas are typically areas with pristine air quality such as national parks, national monuments, or wilderness areas. No areas in the U.S. have been designated as Class III. All other areas in the country are designated as Class II areas. Sources located in an area of a given class are not permitted to emit pollutants at a rate that will cause exceedances of the incremental standards specified for that class.

The project site is contained within a PSD Class II area. The Class II, 24-hour incremental standard for PM_{10} is 27 $\mu g/m^3$ and the annual incremental standard is 19 $\mu g/m^3$. A summary of all Class I and Class II incremental standards is presented in Table 16. The nearest PSD Class I area is Joshua Tree National Monument, 160 km to the northwest. The Monument is too distant to be impacted by emissions from the proposed operation.

Measured Particulate Concentrations. On-site (Padre Madre) and Gold Rock Ranch PM_{10} data from 1988-1992 are presented in Tables 17 and 18, respectively. The data in these tables contain the yearly first and second maxima for each of the sampling locations since 1988. The highest 24-hour PM_{10} concentration was 262 $\mu g/m^3$ on-site and 452 $\mu g/m^3$ at Gold Rock Ranch, both occurring on July 9, 1989. The remaining first and second maxima in these tables indicate that the PM_{10} concentrations measured on July 9, 1989 were abnormally high. Although on-site wind data is not available, National Weather Service (Yuma) information indicates that high winds did occur on that date (i.e., the highest one-minute wind speed for the day was over 17knots). These high winds were likely the cause of basin-wide soil erosion, resulting in unusually high ambient PM_{10} concentrations. Generally, data show that impacts and background levels are similar, implying that background levels of PM_{10} overwhelm PM_{10} effects due to the mining operations at the American Girl Canyon and Padre Madre operations.

The total annual average concentrations are 31.9 $\mu g/m^3$ for on-site monitoring and 26.0 $\mu g/m^3$ for Gold Rock Ranch. The number of measured exceedances per year of the California 24-hour PM_{10} standard at each site is also presented in Tables 17 and 18.

Other NAAQS Pollutant Concentrations. The APCD currently monitors for PM_{10} and ozone (O_3), and has recently begun a monitoring program for NO_x. The PM_{10} data measured on-site and at Gold Rock Ranch, presented in Tables 17 and 18, are more appropriate as a baseline than the APCD PM_{10} data; therefore, APCD data is not presented here. There is no NO_x data yet available from APCD. Results of APCD ozone monitoring are presented below. There is no monitoring of other NAAQS pollutants.

Ozone monitoring data (in parts per million (ppm)) are available for 1990 and 1991. For purposes of comparing Imperial County data to state and federal standards, the data are converted to ug/m^3 at standard temperature and pressure (25°C and 1 atm). For 1990, the maximum 1-hour ozone concentration at the El Centro monitoring station reached 0.11 ppm (216 ug/m^3) and 8 exceedances of the maximum 1-hour California standard (0.09 ppm or 180 ug/m^3) were recorded. The annual average of the daily maximum 1-hour concentrations was 0.048 ppm (94 ug/m_3). The 1991 El Centro data show a maximum 1-hour concentration of 0.11 ppm (216 ug/m^3) and 5 exceedances of the California standard for the year. The annual average of the daily maximum 1-hour concentrations was 0.052 ppm (102 ug/m^3).

TABLE 16

PSD INCREMENTAL STANDARDS

Pollutant	Averaging Period	National Standards in $\mu g/m^3$ Class I	Class II
PM_{10}	24-hour	10	37
	annual	5	19
Sulfur oxides	3-hour	25	512
	24-hour	5	91
	annual	2	20
Nitrogen dioxide	annual	2.5	25

Source: 40 CFR 52.21

TABLE 17

PADRE MADRE PM_{10} MONITORING SUMMARY

Year	Number of Samples	Annual Average ($\mu g/m^3$)	First Maximum Concentration		Second Maximum Concentration		Number of Measured Exceedances
			$\mu g/m^3$	Date	$\mu g/m^3$	Date	
1988*	28	36.0	88	11/23	85	10/24	10
1989	58	44.9	262	7/09	146	10/19	17
1990	49	32.9	110	4/29	90	4/23	9
1991	59	27.5	127	5/30	103	7/05	6
1992	60	19.3	44	4/18**	43	7/17	0
Total Annual Average		**31.2**					

(excluding incomplete data year)
* incomplete data year
** concentration measured on multiple dates

Source: Air Sciences Inc., 1993.

TABLE 18

GOLD ROCK RANCH PM_{10} MONITORING SUMMARY

Year	Number of Samples	Annual Average ($\mu g/m^3$)	First Maximum Concentration		Second Maximum Concentration		Number of Measured Exceedances
			$\mu g/m^3$	Date	$\mu g/m^3$	Date	
1988	48	23.6	50	3/28	39	6/14	0
1989	59	35.3	452	7/09	115	5/10	8
1990*	24	21.1	81	11/07	59	10/20	2
1991	60	28.8	178	12/20	99	5/30**	6
1992	57	18.8	67	11/20	44	4/18	1
Total Annual Average		**26.6**					

(excluding incomplete data year)
* incomplete data year
** concentration measured on multiple dates

Source: Air Sciences Inc., 1993.

In October 1991, a second APCD monitoring station at Calexico (near the Mexico border) was added. Ozone concentrations at this monitor appear to be higher since the maximum ozone concentrations reached 0.18 ppm (353 ug/m^3) and there were 16 exceedances of the 1-hour California standard in three months of monitoring.

Air Toxics. In addition to the standards set for criteria pollutants, the EPA and the State of California also regulate the emissions of hazardous air pollutants (HAPs). Levels of metals, asbestos and crystalline silica are commonly contained in the fugitive dust emissions from mining processes. Title III of the Clean Air Act, as well as California's AB 2588 and Proposition 65, pertain to emissions of these substances and their reporting requirements to the public. There is no current monitoring program for air toxics at or near the project site.

Visibility. The PSD regulations require that any major source that may impact a Class I area conduct an analysis to determine the project's impact on visibility (and other air quality related values (AQRVs)) within the Class I area. Visibility, as an AQRV, can be defined as the degree to which ambient air pollutants obscure a human's ability to see a given reference point through atmosphere. The more a reference point is obscured, the poorer the visibility. The federal government has chosen to protect visibility in Class I areas because vistas are a highly valued aspect of pristine and scenic areas such as national parks and monuments.

None of the information reviewed to date indicates that visibility monitoring has taken place in the vicinity of the project site. The nearest area designated as Class I is Joshua Tree National Monument (approximately 160 km northwest of the site). Due to the project's distance from this area, it is unlikely that any adverse impact on visibility (or other AQRVs) could be attributed to the project's present or future operations.

GEOLOGY

The American Girl Project (including the proposed Oro Cruz operation) is located on the western edge of the Cargo Muchacho Mountains. As described in Loeltz et al. (1974), the Project site is in the Colorado Desert portion of the Basin and Range physiographic province, an area of recurring low mountain ranges, open washes, and alluvial fans. See Figure 20 for the location of the American Girl Project in relation to major geological and topographic features.

The major topographic feature in the region is the Salton Trough, a landward extension of the depression filled by the Gulf of California. The Salton Trough is separated from the Gulf of California by the Colorado River delta. The Coachella Valley, Imperial Valley, and Mexicali Valley form the surface regions of the Salton Trough (Loeltz et al., 1974).

The eastern and northeastern boundary of the Imperial Valley are formed by the northwest trending Chocolate Mountains and the Cargo Muchacho Mountains. The Cargo Muchacho Mountains control the drainage divide for the area, with drainage from the project area moving to the south and west toward the Imperial Valley.

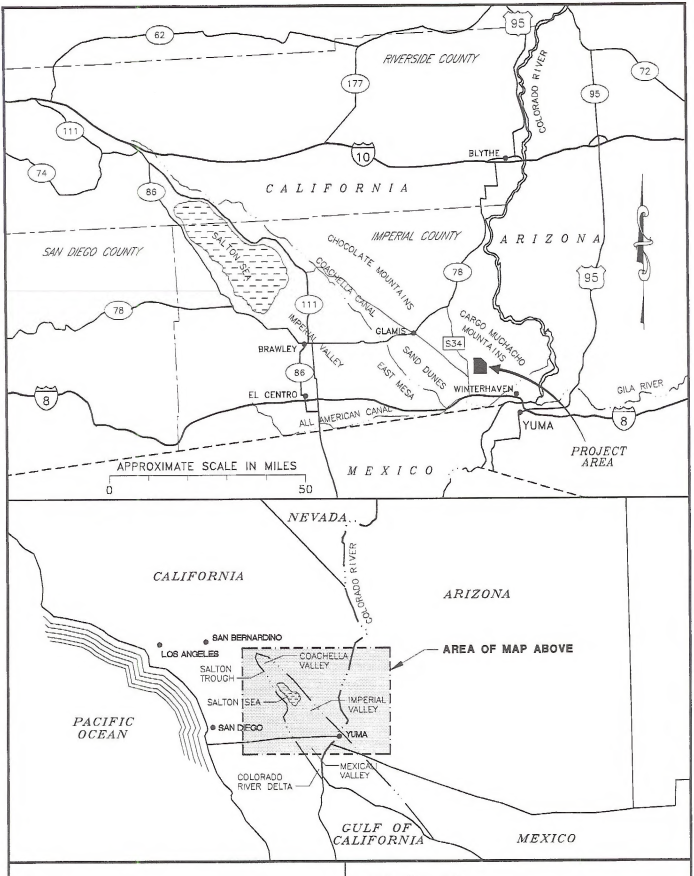


FIGURE 20

SITE LOCATION WITH MAJOR TOPOGRAPHIC FEATURES

To the west and south of the Cargo Muchacho Mountains lies an alluvial plain, known as Pilot Knob Mesa. The surface is extensively dissected by washes and is partly covered with desert pavement. Trees and large shrubs are sparse except along some of the larger washes, where small desert hardwood trees, chiefly palo verde and desert ironwood, are abundant.

The Imperial Sand Dunes lie to the southwest of Pilot Knob Mesa and occupy a belt that is more than 40 miles long and 5 to 6 miles wide. The southwestern margin of the dunes is adjacent to an ancient shoreline that was probably the source of the sand dune material (Loeltz et al., 1974).

Surficial Deposits

Several small washes drain off the southwestern part of the Cargo Muchacho Range. The most notable washes in the area are the Tumco, the American Girl and the Padre Madre, each of which has created a fairly narrow canyon (1,000 to 3,000 ft wide) through the bedrock.

The bottoms of the canyon areas contain locally derived, poorly sorted, unconsolidated alluvial material up to 50 feet thick. Several alluvial fans have developed at the mouths of drainages that issue from the mountains. These alluvial fans seldom exceed a few square miles in areal extent. The fan configuration gradually disappears within about 2 miles of the mountain front as the deposits merge with the broad, gently sloping plain that forms Pilot Knob Mesa.

The thickness and geologic characteristics of the unconsolidated deposits southwest of the Cargo Muchacho Mountains have been evaluated on the basis of exploratory drill holes, water supply wells, and a gravity survey of the area. The locations of those wells and exploration holes are shown in Figure 21.

The approximate configuration of the bedrock surface underlying the unconsolidated deposits southwest of the mountain front is shown in Figure 22. The interpretation of the bedrock configuration was influenced by the results of a gravity survey performed in this area for AGMJV. The bedrock surface is fairly irregular, which may reflect faulting or differential erosion. Generally, the bedrock dips toward the southwest at a rate of 19 percent or 1,000 feet per mile near the mountain front; the dip gradually decreases to about 2 percent or 100 feet per mile, two miles from the mountain front. The topographic surface also dips to the southwest at a lower slope, about 1.5 percent or 80 feet per mile. The result is a gradually increasing thickness of alluvial deposits with increasing distance from the mountain front.

Lithologic logs from drill holes located near the American Girl Mine Road indicate that the surface deposits consist of locally derived, poorly sorted clays, silts, sands, and gravels in the upper 100 to 200 feet. A unit of well-sorted, fine-grained sand 100 to 150 foot thick exists at a depth of about 100 feet below the surface in the vicinity of 26-1 and 25-3 (Figure 21). This unit may be associated with the windblown sand dune deposits a few miles to the southwest. Coarse-grained, well-sorted sands and gravels are encountered in the lower 100 feet of the alluvial sequence directly above the bedrock surface at distances more than 1/2 mile from the mountain

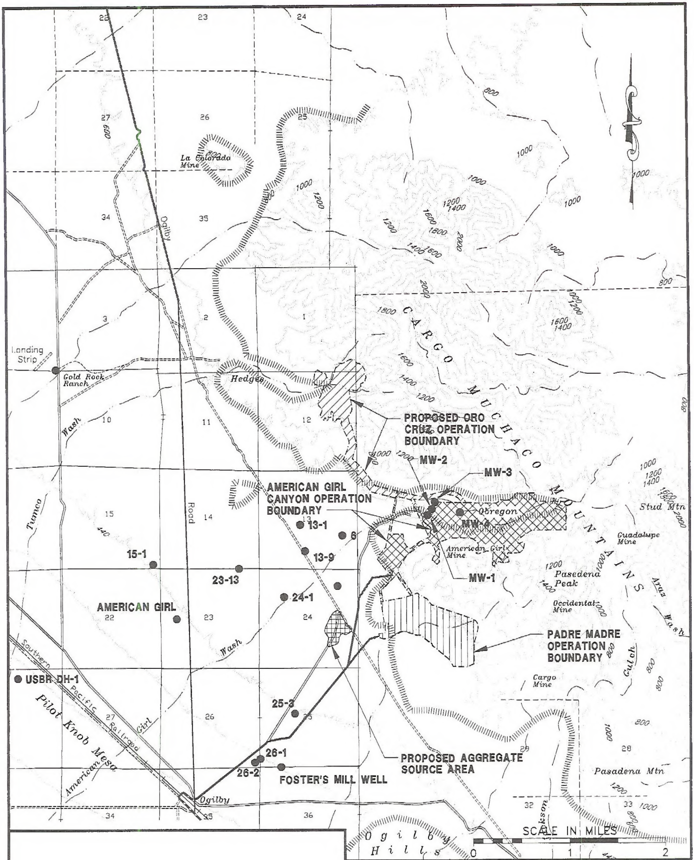
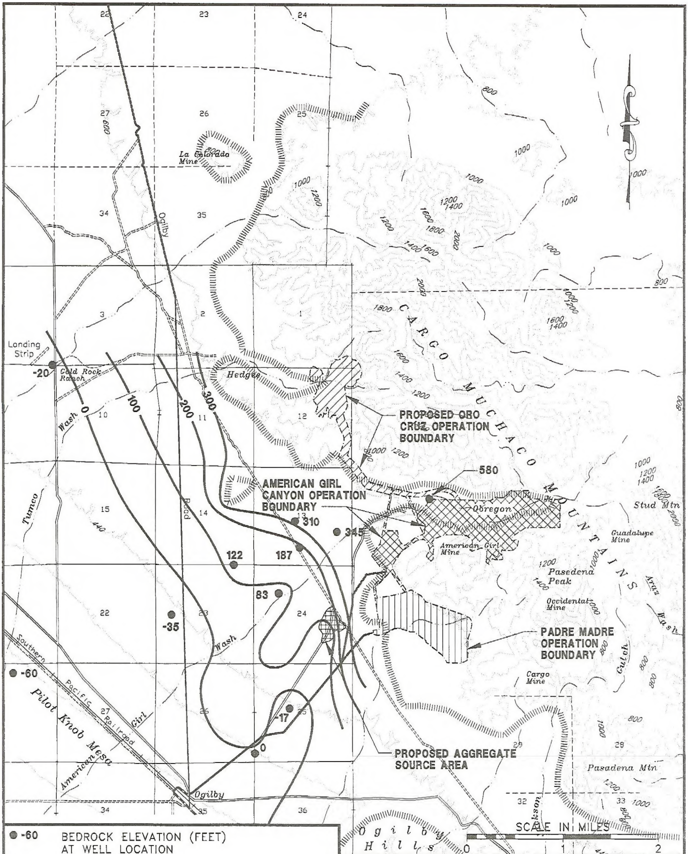


FIGURE 21

WELL LOCATIONS



● -60 BEDROCK ELEVATION (FEET) AT WELL LOCATION

—300— APPROXIMATE BEDROCK SURFACE ELEVATION (FEET)

EDGE OF EXPOSED BEDROCK

NOTE: BEDROCK CONTOURS ADAPTED FROM SRK (1988)

FIGURE 22

BEDROCK CONTOUR ELEVATIONS

front. These deposits contain gravels that exhibit some degree of rounding, which suggests a distant source. They probably represent alluvial deposits from an ancient course of the Colorado River. These relatively clean, unconsolidated alluvial deposits have excellent water-yielding capabilities.

Seismic Setting

Located near the southern end of the San Andreas fault system, the Oro Cruz property occurs in a seismically active area in the United States (ICBO, 1991; U.S. Army Corps of Engineers, 1982). Active and potentially active faults have been identified in the area. One of these identified faults is the Sand Hills Fault (classified as potentially active), which may be an extension of the San Andreas Fault.

For use in design, stability analyses for seismic conditions are typically represented by an equivalent horizontal acceleration, or seismic coefficient. This pseudostatic type of analysis is applicable to structures that would not exhibit liquefaction or strength loss due to seismic shaking. The heap and waste rock dumps at the American Girl Project meet these conditions, being constructed from unsaturated materials and placed on competent foundation materials or bedrock and operated in an unsaturated condition.

Summary of Orebody Mineralization

The Cross ore zone has been partially exploited by past underground mining activity. Underground workings have been encountered in numerous drill holes and have been traced from the surface down-dip approximately 1200 feet. The deepest encountered workings are approximately 450 feet below surface. Mineralization has a strong quartz-magnetite association and is characterized by irregular stringer zones containing the two minerals. High grade zones may occur as semi-massive lenses up to several feet thick. Gold occurs within the magnetite-quartz stringers or is disseminated into the surrounding wall rock.

The Queen pit area is a smaller ore zone occurring immediately north of the Cross. Although it represents a separate and distinct ore zone it is, geologically, very similar to the Cross. The lower portions of the Queen zone have been extensively mined in the past. Because the Cross ore zone extends from outcrop to considerable depths, both surface and underground mining methods would be necessary to extract all the economic mineralization. Due to the lesser downdip extent of the Queen zone and the impact of past mining on the deeper levels, the Queen mine is exclusively a surface mining target.

HYDROLOGY

The project area is located within a desert environment, characterized by high temperatures, low precipitation and scarce natural water resources. The source of virtually all surface waters in Imperial County is the Colorado River. The water is diverted from the Colorado River at the Palo Verde Weir north of Blythe and at the Imperial Dam by the Imperial Irrigation District and the Bard Irrigation District. This water flows into the All-American Canal for use in the Yuma, Bard, Imperial and Coachella Valleys. The Colorado River is also the most important source of recharge into shallow aquifers in the region. Direct recharge from rainfall is very minor.

Surface Water Resources

All the surface drainages in the area are ephemeral, with flows occurring only during and following major precipitation events. Precipitation tends to occur in fairly short, intense events that typically result in runoff events of short duration. Flash flooding and sediment-laden flow are common and result in shifting of drainage channel positions.

The American Girl Canyon, Padre Madre and Tumco watersheds collect and convey storm runoff from the American Girl Project area. The American Girl Canyon watershed has a total area of approximately 5 square miles and an estimated 100-year, 24-hour storm event peak flow of 5,050 cubic feet per second (cfs) north of the mill building. The Tumco Canyon watershed consists of approximately 1.5 square miles producing an estimated 100-year, 24-hour storm event peak flow of 2,750 cfs at the outlet of the canyon. The 100-year, 24-hour storm event precipitation depth is estimated at 3.8 inches. Surface water quality data are unavailable due to the ephemeral nature of the streams.

Groundwater Resources

The Oro Cruz operation would be located on the eastern margin of the Imperial Valley regional groundwater reservoir. Regional groundwater recharge in the Imperial Valley is primarily from the Colorado River. Underflow from tributary areas, direct precipitation, and local runoff are minor additional sources of regional groundwater recharge. Recharge of the Imperial Valley groundwater reservoir is primarily through leakage from canals in the area. Over the last 20 to 30 years, rising groundwater levels have been observed in the upper strata of the Imperial Valley, where leakage from the All-American and Coachella canals serves as the predominant recharge mechanism (Loeltz et al., 1974).

The general regional direction of groundwater movement in the Imperial Valley is toward the axis of the valley and then northwestward toward the Salton Sea. Groundwater elevations indicate that recharge is active west of Pilot Knob as a result of leakage from the All-American and Coachella canals. Between these canals, groundwater movement is generally westward, but south of the All-American Canal the movement is southward. The principal area of groundwater discharge is the central, cultivated part of the valley (Loeltz et al., 1974).

Groundwater in the vicinity of the proposed Oro Cruz operation occurs in the bedrock of the Cargo Muchacho Mountains, in the alluvium of Tumco and American Girl Washes, and in the unconsolidated deposits underlying Pilot Knob Mesa. Groundwater flow in the bedrock of the Cargo Muchacho Mountains is primarily through secondary permeability features such as fractures and faults. The bulk permeability of the bedrock is entirely dependent on the extent and interconnection of these features. Generally, poor fracture connection and resulting low bulk bedrock permeability are indicated by the observed low sustained inflows in the American Girl underground test adit and into the open pit in American Girl Canyon.

The potential for locally derived recharge to the groundwater in the bedrock or the alluvial areas is very low because of the low average annual

precipitation and high runoff. The drainage areas for the Tumco and American Girl Washes are approximately 1.5 and 5 square miles, respectively, and provide relatively small recharge areas.

American Girl Wash. Groundwater elevations in American Girl Wash have been measured in bedrock, and are influenced by both location and depth. The locations of wells that have been used to obtain water level and yield information were shown previously on Figure 21. Water level elevations in shallow bedrock drill holes generally indicate a water table within 100 feet of the bedrock surface. Exploration holes drilled to depths of 500 to 600 feet below ground level have significantly lower water levels. Based on information from the exploration holes and wells drilled in American Girl Canyon, the alluvium is unsaturated.

The lower potentiometric elevations (the level to which water will rise in a well) in the deeper drill holes reflect the general potential for downward groundwater flow in this area. The alluvium of the American Girl Wash area has the potential to provide local recharge to the underlying and adjacent bedrock. The potentiometric data indicate a very low rate of groundwater flow in the bedrock from the canyon area to discharge points either in the existing underground mine areas or in the topographically lower alluvial fill areas to the southwest.

Bedrock in the vicinity of the existing leach pad and open-pit mining area is slightly fractured crystalline and metamorphic rock. Groundwater in bedrock drill holes in these areas occurs at a depth ranging from 35 to 240 feet below ground surface. The wide range of water level elevations observed in bedrock drill holes is strong evidence that fracture interconnection in the bedrock is poor and that bulk hydraulic conductivities of the bedrock are relatively low. Further evidence of generally low bedrock permeabilities is the typically low water yield of bedrock drill holes in the American Girl Canyon operation open-pit mining area and low inflow in the American Girl test adit (generally less than 5 gpm). Inflows to the open pit mine have been found to be insignificant.

Padre Madre Wash. The Padre Madre area has a much smaller drainage area than does American Girl Wash and, therefore, a much lower potential for providing recharge to bedrock groundwater. Two condemnation drill holes about 1,000 feet and 1,500 feet north of the main channel of Padre Madre Wash (east of the existing leach pad) were completed to depths of at least 200 feet below the base of the canyon floor and were dry.

Tumco Wash. Groundwater in the Oro Cruz area is expected to emulate that of the Padre Madre and American Girl Washes. Exploration holes in the Queen and Cross Pit areas have been generally dry to the 500 foot elevation with some seeps and inflows below this elevation. This indicates that the alluvium in Tumco Wash is unsaturated, with varying water levels and groundwater yield in bedrock. Groundwater yield from the exploration holes in bedrock is generally less than 5 gpm, with variable depths to water-producing zones.

Historic underground workings in the Cross mine area contain water at depth, and this water has been encountered in exploration holes at depths of 700 feet, and producing up to 60 gpm. Due to the proximity of

the historic mine adits to the elevation of Tumco Wash, the source of water in the mine workings may be surface runoff. No pump testing or chemical analyses of the mine water has been done.

Pilot Knob Mesa. A potentiometric map for the unconsolidated sediments west of the American Girl Project area is presented in Figure 23. Depths to groundwater range from 200 to 400 feet in this area. The shallow slope of the potentiometric surface indicates that local recharge to the alluvial deposits is very limited. Significantly higher potentiometric levels in the American Girl Wash area indicate the alluvial fan area at the mouth of the canyon may receive some local recharge from alluvial underflow in the canyon. The potentiometric configuration primarily reflects the regional groundwater flow pattern to the northwest, toward the Salton Sea. This suggests that groundwater in the alluvial deposits of Pilot Knob Mesa may be derived from hydraulic communication with the regionally extensive valley fill deposits to the west.

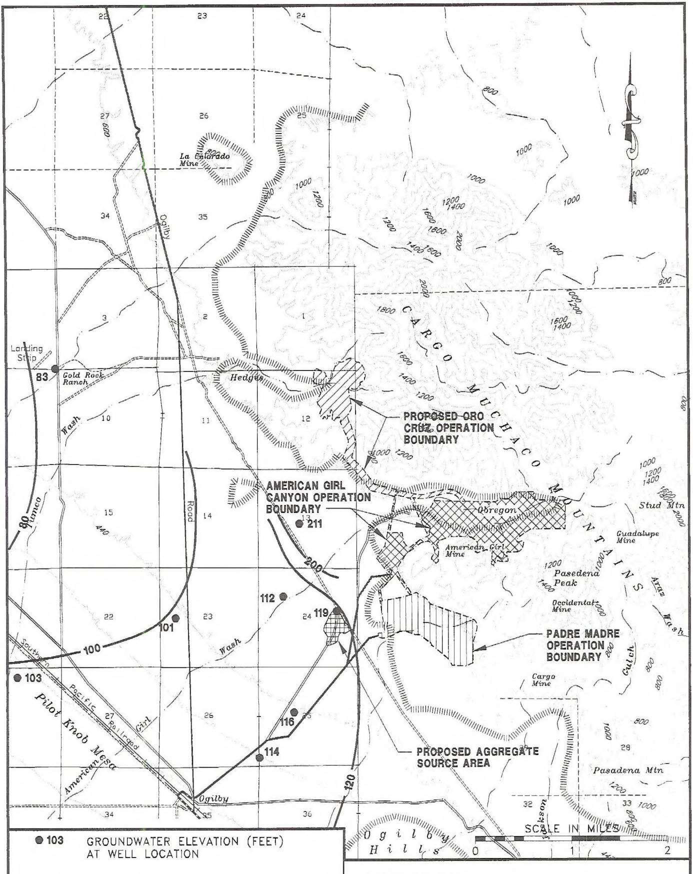
The water-bearing zones of the valley fill deposits are currently receiving significant volumes of recharge from leakage of the All-American and Coachella canals. A small component of recharge to these deposits may be derived from the abundant deep geothermal resources of the Salton Trough via faults in this area. Temperature logs run in Wells 26-1 and 25-3 and the Foster's Mill well indicate unusually high temperatures (between 38 and 46 degrees centigrade) at shallow depth, which may be attributable to this recharge (Geothermal Surveys Inc., 1986).

Hydraulic Characteristics

Hydraulic characteristics of an area describe the location, extent and access to groundwater resources. Estimation of hydraulic characteristics of the unconsolidated deposits in the area was made in the American Girl Canyon EA/EIR based on direct measurements of well yields and well testing, as well as correlation with alluvial material characteristics and saturated thickness. The configuration of the bedrock surface underlying the alluvium and the gently sloping potentiometric surface results in a variable saturated thickness of the alluvial deposits.

Well 26-1 currently provides makeup water for the Padre Madre and American Girl operation. The well derives groundwater from about 120 feet of saturated alluvial deposits at a depth of between 285 and 405 feet. Since startup of operations, no significant drawdown has been observed. A 72-hour pumping and recovery test on Well 26-1 at a sustained pumping rate of 92 gpm yielded a drawdown of 2 feet. The transmissivity of the alluvial deposits in the vicinity of the well, based on analysis of the recovery data, is about 136,000 gallons per day per foot (gpd/ft). Average hydraulic conductivity of the deposits is about 1,100 gpd/ft^2, or 5×10^{-2} cm/sec. Analysis of Well 25-3 and Foster's Mill Well pump tests in the American Girl Canyon area show similar drawdown and recovery data.

The Gold Rock Ranch well is situated in the present drainage path of the Tumco Wash. The well is used as the domestic water supply for the ranch with a current usage rate of 5,000 gallons per day and



● 103 GROUNDWATER ELEVATION (FEET) AT WELL LOCATION

—300— APPROXIMATE POTENTIOMETRIC SURFACE ELEVATION (FEET)

LIMIT OF UNCONSOLIDATED SEDIMENTS

NOTE: POTENTIOMETRIC SURFACE ADAPTED FROM SRK (1988)

FIGURE 23

POTENTIOMETRIC SURFACE MAP FOR GROUNDWATER IN UNCONSOLIDATED SEDIMENTS

a historic maximum usage of 12,000 gallons per day as estimated by the owner. The well owner has not noticed any decline in well yield or in well water levels in the past 10 years.

Groundwater Quality

Water quality characteristics of the Pilot Knob Mesa alluvial aquifer are represented by analyses of samples taken from Well 26-1. Although water quality in Well 26-1 does not meet EPA secondary drinking water standards for chloride, total dissolved solids, and fluoride, the water is suitable for nonpotable use in mining and milling operations. Dissolved metals from Well 26-1 are generally below detection limits, and the dominant ions are sodium, calcium, chloride, and sulfate.

Water quality in the area surrounding the heap leach pad in the American Girl Canyon was sampled September 26, 1989 from monitoring wells MW-1 through 3 (Kleinfelder, 1989). The results show similar water quality to Well 26-1 with the same dominant ions, but with detectable levels of arsenic, manganese, iron and selenium. Water quality results are summarized in Table 19.

Geochemical Influences

Mineralization in the American Girl Project area occurs as magnetite and other oxide minerals. The site is in a naturally alkaline environment with groundwater pH values of roughly 8. Geochemical testing of waste rock and tailings samples for the American Girl Canyon operation indicated that these materials are not acid generating, with acid neutralization potential to acid generation potential (ANP/AGP) ratios greater than 3:1. Batch leach testing of waste rock, tailings, and spent ore samples in SRK (1989) indicate that these materials leach relatively low concentrations of dissolved solids and metals. Disposal of waste rock, tailings and spent ore at the American Girl Canyon operation has resulted in no identified adverse impact to surface water or groundwater.

SOILS

The soils within the American Girl Project area have developed under desert conditions of low moisture, high temperatures and little or no chemical weathering. Soils are a product of the mechanical weathering process in this arid climate and are generally composed of coarse sands, gravel, and cobbles with little profile development. Soils vary from rock outcrops and a thin residual veneer of in-place rock materials on mountain ridges and slopes, to deep, coarse, alluvial material in washes and outwash fans. Old piedmont surfaces, such as desert pavement, have developed a characteristic type of rock surface underlain by vesicular and saline subsoils peculiar to this desert region.

Many locations in the Oro Cruz area previously had the soil surfaces disturbed by mining. Previous mining disturbances include roads, mine rock waste dumps, mine openings/adits, tailings disposal, townsites and buildings, mills and milling operations. Tailings were allowed to flow out from the mills in unconfined sheets covering large areas of Tumco Wash and extending westward onto the alluvial fans. In place in south-central Tumco Wash, tailings have blown

TABLE 19

SUMMARY OF WATER QUALITY ANALYSES

Parameter	Well 26-1 7/29/86	Well 26-1 8/01/86	Well MW-1 8/26/89	Well MW-2 8/26/89	Well MW-3 8/26/89
pH	8.0	8.0	7.82	7.97	8.05
Conductivity (μmhos/cm)	2000	1400	3480	2550	860
TDS (mg/l)	1100	1400	3076	1708	‘485
Hardness (mg $CaCO_3$/l)	N/A	N/A	1400	580	75
Alkalinity (mg $CaCO_3$/l)	73	80	234	178	108
Chloride (mg/l)	400	360	N/A	N/A	N/A
Nitrate (mg/l)	3.1	3.7	<0.1	<0.1	1.7
Sulfate (mg/l)	170	170	1400	73	88
Fluoride (mg/l)	N/A	6.2	3.5	2.4	4.6
Cyanide (mg/l)	N/A	N/A	<0.01	<0.01	<0.01
Calcium (mg/l)	41	42	400	140	17
Magnesium (mg/l)	0.48	0.50	95	54	7.8
Potassium (mg/l)	8.0	8.0	N/A	N/A	N/A
Sodium (mg/l)	320	330	320	300	160
Arsenic (mg/l)	N/A	<0.02	0.007	0.015	0.028
Barium (mg/l)	N/A	0.011	N/A	N/A	N/A
Cadmium (mg/l)	N/A	<0.006	N/A	N/A	N/A
Chromium (mg/l)	N/A	<0.03	0.002	0.002	0.002
Copper (mg/l)	<0.02	<0.02	<0.02	<0.02	<0.02
Iron (mg/l)	<0.2	<0.2	0.18	0.21	0.27
Lead (mg/l)	N/A	<0.02	0.0005	<0.001	<0.001
Manganese (mg/l)	<0.01	<0.01	0.48	0.48	0.02
Mercury (mg/l)	N/A	<.0006	<0.001	<0.001	0.0005
Selenium (mg/l)	N/A	<0.02	0.054	0.120	0.170
Silver (mg/l)	N/A	<0.02	N/A	N/A	N/A
Zinc (mg/l)	<0.04	<0.04	0.02	<0.02	<0.02
Gross Alpha (pCi/l)	N/A	2	N/A	N/A	N/A
Gross Beta (pCi/l)	N/A	1	N/A	N/A	N/A

into shallow sand dunes to the south and west of the lower mill tailings site.

Soil Types

Soils have developed from weathered host granitic and schistose rock substrates and consist of extremely gravelly sands or gravelly loams with up to 90% coarse fragments. Soils in the Oro Cruz area are fairly stable and are of 2 general types based on substrates and topographic position: (1) residual soil material weathered in place on slopes and ridges and (2) deeper alluvial soils transported by water and gravity on toe slopes, washes and outwash fans. Rock outcrops on peaks, ridges, and knobs occur throughout the area. Cobbles and rock fragments are common on the ground surface and form part of the weathered desert pavement on stable bajadas. Many of these surfaces have not been eroded or disturbed for thousands of years. In contrast, soils in wide active washes are frequently moved and sorted by periodic heavy rains and floods. Many exposed rock surfaces are stained black or various shades of brown by manganese and iron oxides forming the desert varnish.

Soils within the Oro Cruz area have not been mapped by the U.S. Soil Conservation Service (SCS) nor are any SCS surveys planned in the near future. The area to the east in eastern Imperial County and adjacent Yuma County in Arizona have a completed and published soil survey (SCS 1980) in areas with similar soils and climate. These soil surveys provided the basis for the information in this report for soil types and characteristics. Two previous studies on the soil resources in the adjacent American Girl Canyon and Padre Madre operation areas also provided some information on study area soils.

Six soil types or classifications were determined to exist on the Oro Cruz site. These soil types are summarized in Table 20. These soil types are, in decreasing order of depth, rock, and slope: Rock outcrop, Laprosa, Carrizo, Torriorthent-Torrifluvent Complex, Ligurta, and Cristobal. Because these types occur in mixed complexes or mosaics, they are commonly grouped for mapping purposes (see next section). Extensive disturbance from mining activities created an additional soil unit that is not a soil series.

Soil Mapping Units

Soils on the landscape comprise complexes or mosaics of the above types, and these are grouped into 5 soil mapping units. These mapping units are shown in Figures 24 through 26 and Table 21. Four of the mapping units are natural groupings of 1 or more soil series, the fifth is the variable disturbed substrate material resulting from mining activities.

The map unit descriptions are described below. Each unit is described based on location and topographic position, soil series in the unit, depths, and textural characteristics affecting use and limitations of the soils for reclamation. The soil mapping units are adapted from results of the SCS regional survey (SCS, 1980):

- *The Laprosa-Rock Outcrop complex is developed on higher peaks, ridges, and slopes throughout the site and is the most common complex on the site. The complex occurs on slopes ranging from 15 to 75%, rock outcrops*

TABLE 20

CLASSIFICATION OF NATURALLY OCCURRING SOILS IN THE STUDY AREA

TAXONOMIC UNIT	CLASSIFICATION	TOPOGRAPHIC POSITION
Rock outcrop	Exposed granite or schist	Mountain tops and ridges
Laprosa	Loamy-skeletal, mixed hyperthermic Typic	Hills and mountain slopes
Carrizo	Sandy-skeletal, mixed hyperthermic Typic	Recent alluvial fans and washes
Torriorthent-Torrifluvent Complex		Dissected alluvial fans and terrace escarpments
Ligurta	Fine-loamy, mixed, hyperthermic Typic Haplargids	Old alluvial fans piedmonts
Cristobal	Loamy-skeletal, mixed hyperthermic Typic Haplargids	Old alluvial fans and terraces

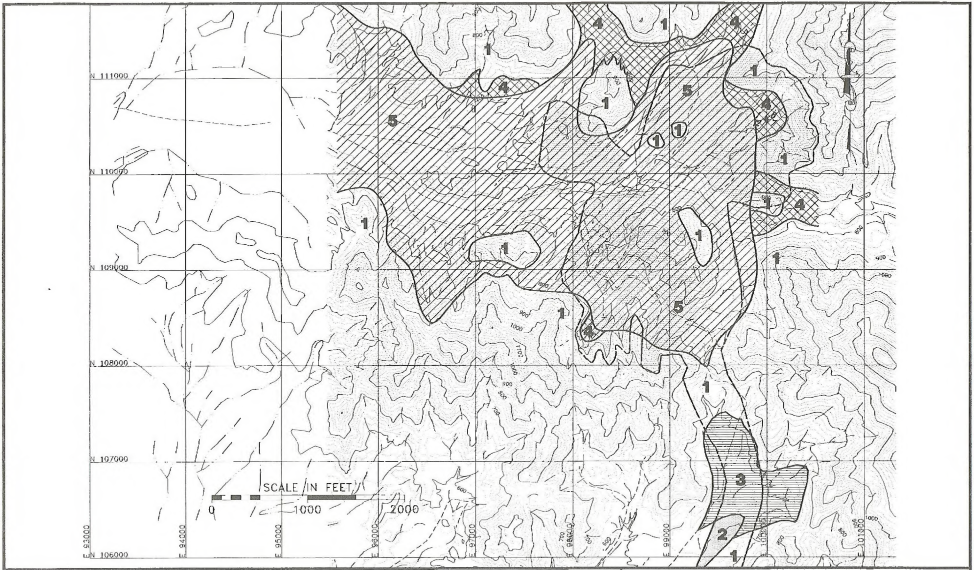
Source: SCS 1980

are frequent, and depths to bedrock are less than 40 inches. The texture is a very gravelly loam with a high percentage of pebbles and cobbles. There are severe limitations for salvage and use of these soils for reclamation, including non-existent to shallow depths, a large percentage of rock fragments, and difficulty in removal due to steep slopes and the small extent of deeper soil units.

- *The Ligurta-Cristobal complex forms on old, weathered piedmont alluvial fans and terraces along washes and foothills. The surfaces of these soils are stable and consist of small varnished rock fragments underlain by a saline vesicular subsoil. Soil depths are usually greater than 60 inches. These soils have limitations for reclamation due to the strongly saline subsoil and the gravelly or clayey textures.*

- *The Carrizo complex soils form in mixed alluvium of major washes and recently deposited alluvial outwash fans. Soil depths are greater than 60 inches, and may be sorted by flooding in the washes or fans. The texture is a well drained, very gravelly sand. These soils can be salvaged and used for reclamation, however the sandy texture of these soils limits plant growth and forms a draughty substrate if placed over porous soils or rock fragments. The top 6 inches of these soils will be a source of seeds for reclamation.*

- *The Torriorthents-Torrifluvents complex is deep well-drained soils in eroded mixed alluvial materials that are unconsolidated. They are variable in texture and consists of a sandy to clay stratified layer with 30 to 50% rock fragments. These soils are partially weathered and may be used for reclamation. The main limitation of these soils derive from their dissected and discontinuous nature making salvage of these soils difficult.*



LEGEND - SOIL TYPES

1 LAPROSA-ROCK OUTCROP COMPLEX

2 LIGURTA-CRISTOBAL COMPLEX

3 CARRIZO

4 TORRIORTHENTS-TORRIFLUVENTS COMPLEX

5 MINES\WASTE\TAILINGS

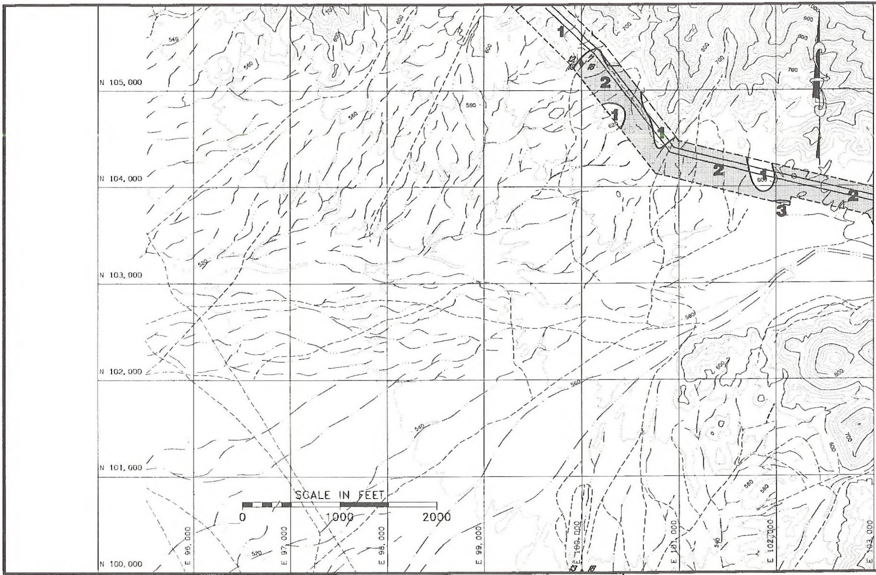
--- BOUNDARY OF ORO CRUZ OPERATION AND HAUL ROAD CORRIDOR

KEY

1		
	2	3

FIGURE 24

SOILS MAP - UPPER ORO CRUZ CORRIDOR



LEGEND – SOIL TYPES

1 LAPROSA–ROCK OUTCROP COMPLEX

2 LIGURTA–CRISTOBAL COMPLEX

3 CARRIZO

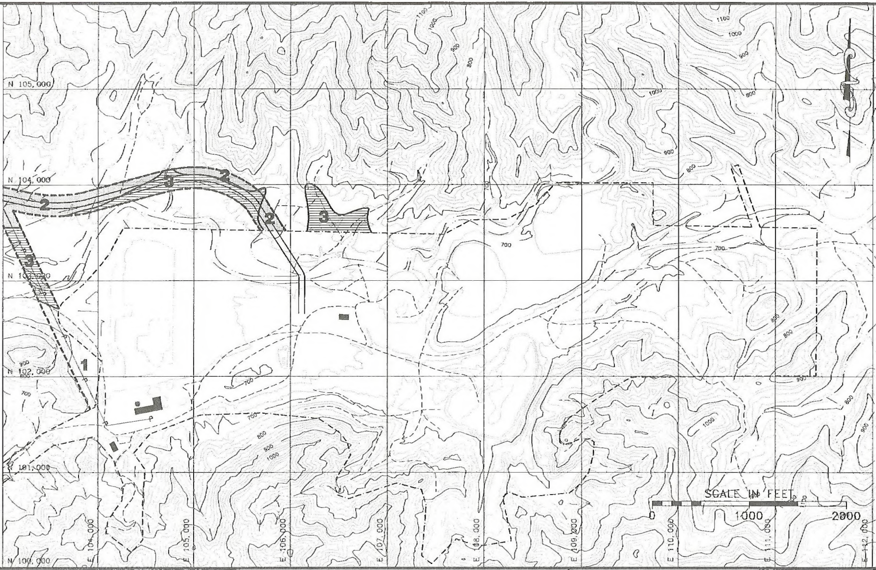
KEY

1

2 3

FIGURE 25

SOILS MAP – MIDDLE ORO CRUZ CORRIDOR



LEGEND - SOIL TYPES

1 LAPROSA-ROCK OUTCROP COMPLEX

2 LIGURTA-CRISTOBAL COMPLEX

3 CARRIZO

BOUNDARY OF ORO CRUZ HAUL ROAD CORRIDOR

KEY

1		
	2	3

FIGURE 26

SOILS MAP - LOWER ORO CRUZ CORRIDOR

TABLE 21

SOIL SERIES OCCURRING IN THE ENVIRONMENTAL STUDY AREA

MAP UNIT NO.	SOIL SERIES	TEXTURES	PERCENT SLOPE
1	Laprosa-rock outcrop complex	Extremely gravelly loam; exposed bedrock	15 to 75
2	Ligurta-Cristobal complex	Gravelly clay loam	2 to 6
3	Carrizo	Very gravelly sand	2 to 15
4	Torriorthents-Torrifluvents complex	Sandy loam	1 to 40
5	Mines/waste/tailings	Variable	Variable

Source: SCS 1980 (modified)

- *Disturbed mined surface materials are variable substrates that consist of disturbed, mixed in-place soils, mine wastes dumps, graded road surfaces, debris and foundations from the town and mill buildings, and tailings material deposited in place and subsequently wind-blown into dunes. These materials are generally not suitable for salvage for reclamation, although some natural revegetation has occurred.*

Soil Handling and Salvage Potential

Desert soils generally have poorly developed profiles, and old piedmont surfaces such as desert pavement do not contain salvageable surface soil materials for reclamation. Much of the area proposed for mine development is already highly disturbed and is not suitable for salvage and reclamation use.

Transported alluvial substrates in the washes are generally the best source of weathered materials and as a seed source for reclamation. The amount and depth of this material is not fully known. Revegetation testing programs are presently being conducted at American Girl Canyon and the Padre Madre sites. The results of these testing programs will be used to direct soil handling and salvage in Tumco Wash for Oro Cruz development (see discussion of the Reclamation Plan in Chapter 2).

VEGETATION

Vegetation on the Oro Cruz site is low desert scrub typical of the high temperature desert region in southeastern California. Vegetative cover is extremely low and variable, and species diversity is minimal. The existing vegetation is highly adapted to the desert heat and droughts. On the upland slopes and ridges, vegetation consists mostly of scattered creosote bush with occasional ocotillo, inciensio, fagonia, and beavertail cactus. The frequent washes in the canyons and flats provide a break in the desert pavement, collect rain run-off, and support a greater variety of plants including large shrubs and small trees, and a larger ground cover. Low rainfall (typically 2-3 inches per year) and the high daytime temperatures (up to 115°F) impose special requirements on the plant life.

Species Identification

Vegetation in the proposed Oro Cruz operation area is composed almost entirely of common native species, with few weeds or introduced species. The area contains no unusual species or habitat. Species observed or collected within the area are listed in Table 22. The dominant life forms are widely spaced shrubs that are largely dormant during dry periods, with annual and perennial forbs growing seasonally and where conditions permit. Small trees and large shrubs dominate the washes. There is no permanent surface water or springs in the area and no wetlands. The flora does not have a large number of plant species due to the extreme dryness and lack of diverse habitats. The fairy duster, which is on the California Native Plant Society Watch List, occurs in shallow, side canyons, toeslope washes and along highways in the region. Fairy duster was not observed in the area of potential effect of the proposed action.

Vegetation Types

This area of the California Desert has been classified into one general vegetation type, the creosote bush scrub (Munz and Keck, 1968). Two distinctive vegetation subtypes were determined through field studies (Bamberg, personal communication, 1993) in the area: (1) a shrub scrub subtype on the open, drier flat alluvial fans and mountain slope regions and (2) a mixed shrub/tree subtype in drainage areas in canyons along washes. Of the former areas, the desert pavement is extensive and the vegetative ground cover is less than 1%. The second subtype reflects the higher moisture availability resulting from precipitation run-off. Canyon vegetation has higher variability in structure, species composition, and ground cover. Vegetation types are further discussed below, and detailed maps of vegetation locations are included as Figures 27 through 32.

Flat Area and Mountain Slope Vegetation (Shrub Scrub Subtype). On the open, drier, flat alluvial fans and mountain slope regions the shrub scrub vegetation subtype consists of widely spaced low shrubs. Dominant shrubs are creosote bush, Burrobush, inciensio, fagonia, hibiscus and ocotillo. These species composing the shrub scrub subtype vary in their distribution and abundance throughout the site. For the SMARA Reclamation Plan, 4 topographic divisions of the shrub scrub vegetation subtype have been identified: (1) rock outcrop/thin soil, (2) mountain and toe slopes, (3) alluvial fans and flats, and (4) desert pavement.

- *The rock outcrop/thin soil areas occur on the upper to mid-ranges of the mountain slopes. Vegetation grows in the cracks of, and between, rocks. The density of the vegetation is very low and is clumped around the thin soil deposits and cracks in the rocks. The rocks have been highly baked by the sun and arid climate and are covered with desert varnish. An estimated 0 to 2 percent of the ground is covered by vegetation.*

TABLE 22

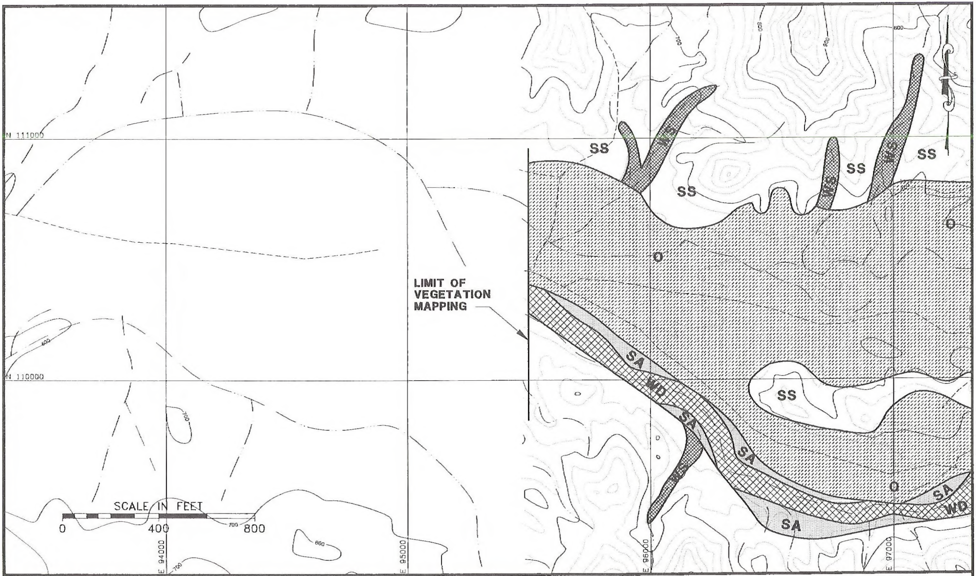
LIST OF PLANT SPECIES OBSERVED IN OR NEAR AREA OF PROPOSED ACTION

Common Name	Scientific Name
Trees and Tall Shrubs	
Ironwood	*Olneya tesota*
Mesquite	*Posopis juliflora*
Mistletoe (parasitic on trees)	*Phorandendron californicum*
Palo verde	*Cercidium floridum*
Smoke tree	*Dalea spinosa*
Tamarisk	*Tamarix pentandra*
Shrubs	
All-scale saltbush	*Atriplex polycarpa*
Boxthorn	*Lycium andersonii*
Burrobush	*Ambrosia dumosa*
Catsclaw	*Acacia greggii*
Creosote bush	*Larrea divaricata*
Desert ratany	*Krameria grayi*
Desert lavender	*Hyptis emoryi*
Ditaxis	*Ditaxis lanceolata*
Fairy duster	*Calliandra eriophylla*
Happlopappus	*Happlopappus acradenius*
Inciensio	*Encelia farinosa*
Indigo bush	*Dalea schottii*
Joint-fir	*Ephedra trifurca*
Ocotillo	*Fouquieria splendens*
Pygmy cedar	*Peucephyllum schottii*
Sandpaper plant	*Petalonyx thurberi*
Sweetbush	*Bebbia juncea*
Tobacco	*Nicotiana trigonophylla*
Grasses	
California three-awn	*Aristida californica*
Galleta	*Hilaria jamesii*
Big galleta	*Hilaria rigida*
Grama grass	*Bouteloua barbata*
Six-week fescue	*Festuca octoflora*
Three-awn	*Aristida adscensionis*
Tufted grass	*Schismus arabicus*

TABLE 22 cont.

LIST OF PLANT SPECIES
OBSERVED IN OR NEAR AREA OF PROPOSED ACTION

Common Name	Scientific Name
Herbaceous Perennials and Annuals	
Barked evening primrose	*Oenothera decorticans*
California poppy	*Eschscholtzia minutiflora*
Chaenactis	*Chaenactis stevioides*
Cheesebush	*Hymenoclea salsola*
Club evening primrose	*Oenothera clavaeformis*
Desert star	*Monoptilon bellioides*
Desert sunflower	*Geraea canescens*
Desert marigold	*Baileya pauciradiata*
Eriogonum	*Eriogonum spp.*
Fagonia	*Fagonia californica*
Forget-me-not	*Cryptantha spp.*
Four o'clock	*Mirabilis froebeilii*
Ground cherry	*Physalis crassifolia*
Milkweed	*Asclepias subulata*
Orange globemallow	*Sphaeralcea emoryi*
Parry's indigo	*Dalea parryi*
Peppergrass	*Lepidium lasiocarpum*
Phacelia	*Phacelia crenulata*
Plantain	*Plantago insularis*
Psathyrotes	*Psathyrotes ramossissima*
Rambling milkweed	*Sacrostemma hirtellum*
Rose mallow	*Hibiscus denudatus*
Soft indigo	*Dalea mollis*
Spanish needles	*Palafoxia linearis*
Spiny chorizanthe	*Chorizanthe rigida*
Spurge	*Euphorbia eirantha*
Triangle evening primrose	*Oenothera deltoides*
trixis	*Trixis californica*
Western jimson weed	*Datura meteloides*
Western ragweed	*Ambrosia psilostachya*
Wire lettuce	*Stephanomeria pauciflora*
Cactus	
Barrel cactus	*Echinocactus acanthodes*
Beavertail cactus	*Opuntia basilaris*
Buckthorn cholla	*Opuntia acanthocarpa*
Golden cholla	*Opuntia echinocarpa*
Nipple or fishhook cactus	*Mammillaria tetrancistra*



LEGEND - VEGETATION

- O DISTURBED
- SA SHRUB-ALLUVIAL
- SS SHRUB-SLOPE/OUTCROP
- WS WASH-SHALLOW
- WD WASH-DEEP

KEY

1 2 3 4 5 6

FIGURE 27

VEGETATION MAP - SHEET 1

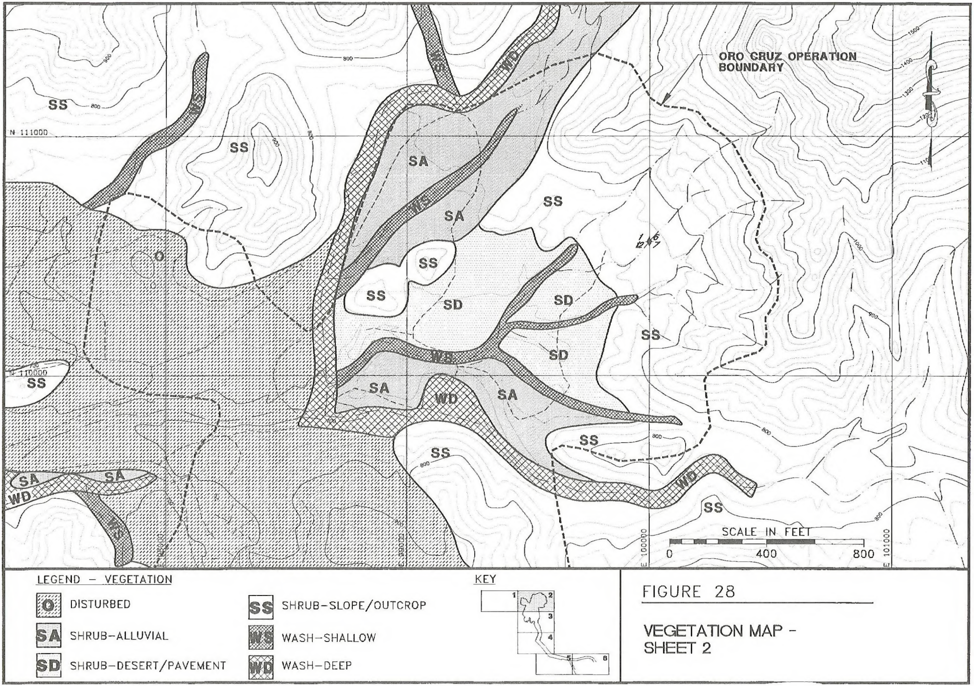
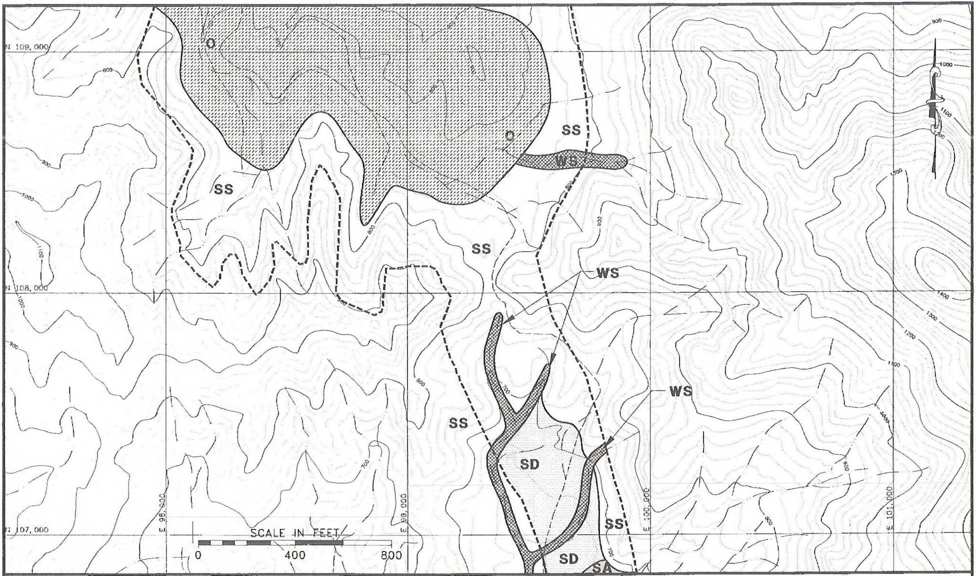


FIGURE 28

VEGETATION MAP - SHEET 2



LEGEND - VEGETATION

O DISTURBED	SS SHRUB-SLOPE/OUTCROP
SA SHRUB-ALLUVIAL	WS WASH-SHALLOW
SD SHRUB-DESERT/PAVEMENT	---- ORO CRUZ OPERATION AND HAUL ROAD CORRIDOR

KEY

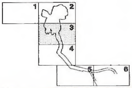


FIGURE 29

VEGETATION MAP - SHEET 3

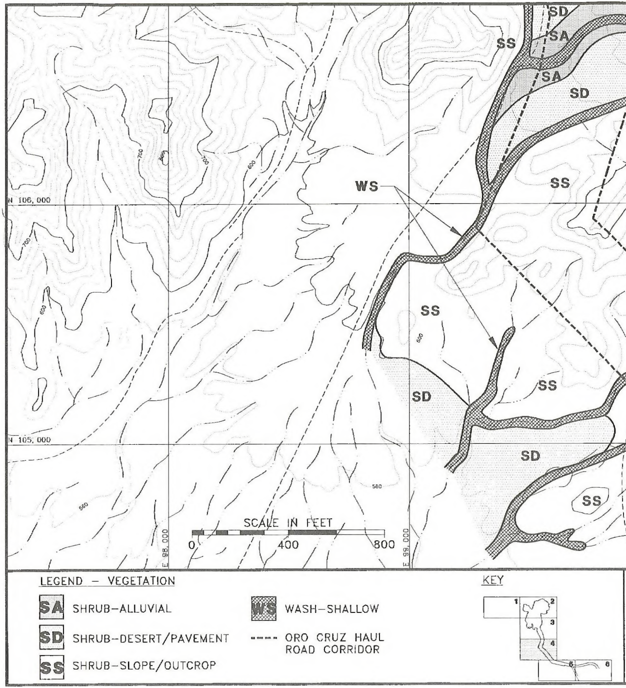


FIGURE 30

VEGETATION MAP - SHEET 4

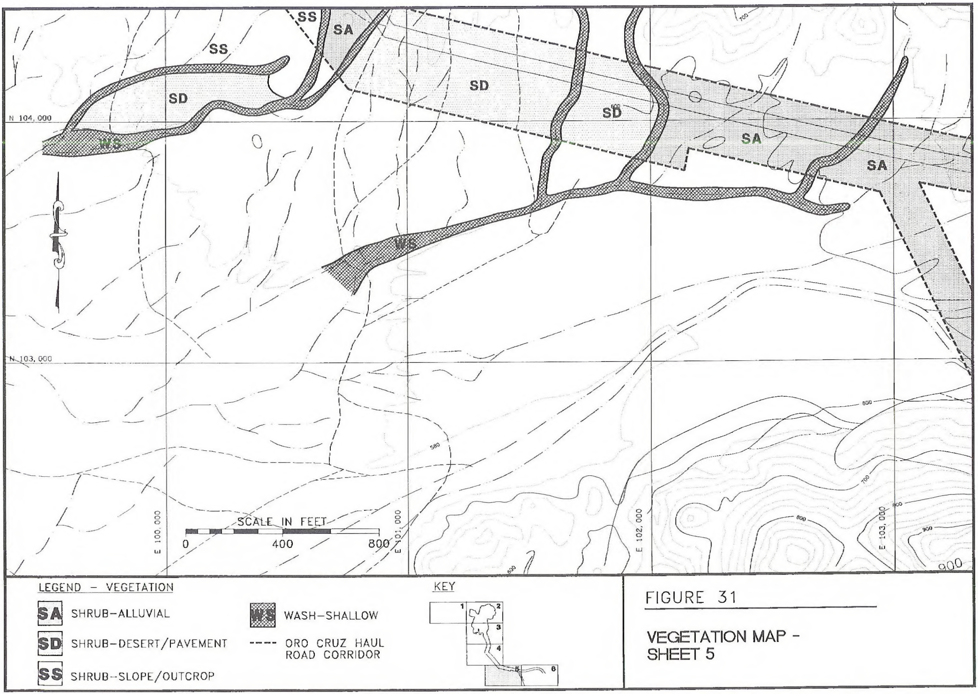
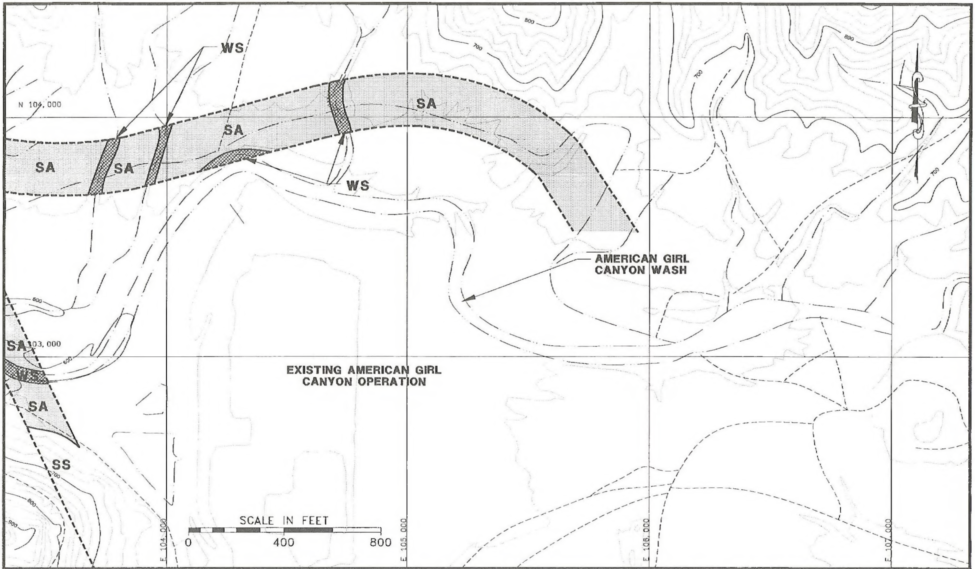


FIGURE 31

VEGETATION MAP - SHEET 5



LEGEND - VEGETATION

SA SHRUB-ALLUVIAL

SS SHRUB-SLOPE/OUTCROP

WS WASH-SHALLOW

--- ORO CRUZ HAUL ROAD CORRIDOR

KEY

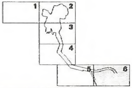


FIGURE 32

VEGETATION MAP - SHEET 6

- *Colluvial soils material is available between the rock outcrops on the mountain slopes and on the toe slopes. The vegetation here is denser and has a higher diversity of plant species than on rock outcrops and thin soils. The plants also tend to be more evenly spaced than in the rock outcrop areas. Vegetative ground cover is estimated at 1 to 3 percent.*

- *The alluvial fans and flats start in the toe slopes and continue out onto the outwash plains beyond the mountain range. The soil is a coarse sand and rock of more recent deposition. Plant density is the highest in these areas with a relatively high diversity. Plants are clumped and dependent on soil type and water availability. Two surveys for vegetative cover were conducted in the alluvial outwash fans in the major wash to the north of Tumco Wash. Measured ground cover for the alluvial outwash and the dissecting shallow washes were 3.3 and 1.8 percent. The estimated ground cover for the alluvial outwash alone was 1 to 3 percent.*

- *The desert pavement is found on the mountain slopes, alluvial flats, and on undisturbed sun-baked surfaces. These sloping to flat sand and rock surfaces have weathered in-place by the sun and cyclic arid climate and form an impenetrable surface with high salt content. Vegetation cover is extremely low; water and seeds generally cannot penetrate the surface. A type of lichen/algal crust forms on the underneath side of quartz rocks, which light can penetrate and where moisture can collect. Measured ground cover for the desert pavement and the dissecting shallow washes was 0.7 and 1.4 percent. Estimated ground cover for the desert pavement areas alone was 0 to 0.5 percent.*

Canyon/Wash Vegetation (Mixed Shrub/Tree Subtype). Canyon vegetation is confined to washes created by the major water runoff from the steep mountain slopes during significant precipitation events. Flooding, washing, and deposition of the alluvial/colluvial material in the canyons and on the older, weathered surfaces allows for better penetration of water and seed, and promotes higher survival and growth rates than on the shrub/scrub vegetation type. This results in a greater variety of plant species and a higher abundance of plants. The major species include those found in the shrub scrub vegetation type plus other species confined to the washes.

Four topographic divisions of wash vegetation types have been identified. These are (1) broad major washes in large canyons, (2) smaller canyon and side washes, (3) alluvial shallow washes, and (4) desert pavement shallow washes.

- *The broad major washes form in the valleys between the mountain slopes and continue out a short distance onto the alluvial flats. These washes can vary from 10 to 20 feet deep and 50 to 100 feet wide. The sandy bottoms and sides of the washes support trees and a higher cover of plants. Occasional islands of dense vegetation form in the middle of the sandy bottoms. Vegetation in the major washes is the most abundant and diverse within the Oro Cruz site. Trees found in the major washes include the dominant ironwood and palo verde, with locally abundant smoke tree, and a few mesquite and Tamarisk. Plant cover varies from 0 percent in*

sandy bottom areas to 60 percent on some side slopes and island vegetative clumps.

- *The canyon and side wash vegetation is similar to that in the major washes, but is less diverse and abundant. These washes are narrower and shallower. There are fewer and smaller trees. Galleta, milkweed, pygmy cedar, fairy duster and desert lavender are common species. Canyon sides support populations of barrel cactus. Vegetative cover is irregular on the bottoms and sides, varying from 6 to 15 percent.*

- *The alluvial shallow washes contain few trees and the shrubs are smaller and more widely spaced. Ocotillo, creosote bush, burro bush, desert ratany and rose mallow are the most common plants. The upper portion of the shallow washes may also have fairy duster. The shallow washes dissecting the alluvial fans were included in the cover analysis for alluvial fans (1.4 and 0.7 percent cover). Estimated cover for the washes alone is 3 to 5 percent.*

- *The desert pavement shallow washes have the lowest cover of the wash vegetation divisions. These washes penetrate the old desert pavement surfaces and allow for better moisture conditions. Plant cover in the shallow washes dissecting the desert pavement (measured at 3.3 and 1.8 percent when included with the pavement) are estimated at 1 to 3 percent.*

Threatened and Endangered Plant Species

Currently there are no known threatened or endangered plant species in this region of the California desert. Previous surveys for the fairy duster demonstrated good abundance and vigorously growing, reproducing populations of this plant around the Cargo Muchacho Mountains, and there is little threat to its existence at the present time. The fairy duster is generally found in secondary drainages dissecting the desert pavement, from toe slopes to flat alluvial areas away from the mountains. Plants have vigorous growth, good seedling reproduction, and are not declining or in danger in the Tumco Wash and adjacent washes to the north. A fairy duster count west (downgradient) of Tumco Wash on the southwest central portion of the proposed Oro Cruz operation area was conducted on June 3, 1990. The survey located 93 plants in main wash just north of entrance road, 14 plants in washes to the north of main wash, and 44 plants in washes to the south of main wash. This count did not include sections 35, 36, and 24 in the northern portions of the study area. Fairy dusters were observed in these portions of the study area, but extent and abundance were not quantified, because these areas are not in the proposed disturbance area.

Natural Revegetation

Observations have been made of the natural revegetation that has occurred on historic waste rock,

tailings, roads, and the old town sites. Plant growth was best with the local, native species in flat or slightly depressed areas with medium textured soils. Upland species had good density and growth after establishment in the roads and waste rock. Disturbed washes had vigorous and large wash species (including both ironwood and palo verde) which had grown in the past 50 years after the early mine sites were mostly abandoned. The townsite in the American Girl Canyon was on the bench above the wash and had revegetated to an upland type vegetation with creosote bush and burrobush most prominent. No weedy or exotic species of plants were noted in the naturally revegetation areas, including the townsite.

Creosote bush, burrobush, inciensio, hibiscus, ocotillo and cattle spinach were the plant species observed to naturally revegetate in roads, waste rock and exploratory drill sites left from previous exploration activities. Species of grass (three-awn and six weeks fescue) and annual forbs (such as eriogonum, plantago and primrose) were also observed in the disturbed areas. All-scale saltbush, palo verde and creosote bush have been re-established in and around old tailings areas. In addition to the species listed above, desert lavender, milkweed, sweetbush and catsclaw were observed in depressions and blocked drainages left from mining. No weeds were observed. Plant seed that can be collected have been observed and tested for their ability to germinate and survive in the revegetation test plots. Table 23 lists these species.

WILDLIFE

The wildlife community in the Oro Cruz area is representative of the extreme environmental conditions of the California Desert and the degree to which native habitats have been altered by, and recovered from, historic mining disturbances. During wildlife baseline surveys, evidence of 26 native mammal species, 2 non-native mammals, 23 resident or breeding birds, 11 reptiles, and 1 amphibian was detected within the Oro Cruz area. Common and scientific names of wildlife mentioned in the text are listed in Table 24.

Nine Federal or State threatened, endangered, and candidate species are present, or potentially present within the proposed operation area. The desert tortoise, a Federal and State threatened species is present at low densities. A Bell's vireo was detected in Tumco Wash during May 1992 baseline surveys. Two breeding subspecies of this bird, Arizona Bell's vireo and least Bell's vireo, are listed as state endangered, and state and Federal endangered, respectively. Two Federal candidate species are also present on the site, including the loggerhead shrike and California leaf-nosed bat (both Category 2 [C2] species and California "Species of Special Concern" [CSC]). The pallid bat, another CSC, also occurs in the Oro Cruz area. Evidence and possible evidence of four additional Federal candidate bats, including spotted and California mastiff bats (echolocation signals detected, both C2 and CSC species), and cave

TABLE 23

LIST OF PLANT SPECIES NATURALLY RESEEDING IN DISTURBED AREAS WITHIN THE AMERICAN GIRL PROJECT AREA

Common Name	Scientific Name	Location (Type of Disturbance)
TREES AND TALL SHRUBS		
Ironwood	*Olneya tesota*	washes, depressions
Palo verde	*Cercidium floridum*	washes, mine wastes
SHRUBS		
Burrobush	*Ambrosia dumosa*	mine wastes; drill roads, pad
Catsclaw	*Acacia greggii*	depressions; tailings; drainages
Creosote bush	*Larrea divaricata*	mine wastes; tailings; drill roads, pad
Desert lavender	*Hyptis emoryi*	washes and depressions
Inciensio	*Encelia farinosa*	mine wastes; depressions; drill roads, pad
Milkweed	*Asclepias subulata*	washes and depressions
Ocotillo	*Fouquieria splendens*	mine wastes and tailings
Rose mallow	*Hibiscus denudatus*	mine depression; tailings; drill road, pad
Sweetbush	*Bebbia juncea*	washes and depressions; drill roads, pad
Cattle spinach	*Atriplex polycarpa*	tailings
GRASSES		
Six-week fescue	*Festuca octoflora*	mine wastes
Three-awn	*Aristida adscensionis*	drill road, pad
FORBS		
Eriogonum	*Eriogonum deflexum*	washes; tailings
Fagonia	*Fagonia californica*	mine wastes; drill roads, pad
Orange globemallow	*Sphaeralcea emoryi*	mine wastes
Plantain	*Plantago insularis*	mine wastes
Primrose	*Oenothera sp.*	washes; tailings
CACTUS		
Beavertail cactus	*Opuntia basilaris*	mine wastes; tailings

TABLE 24

WILDLIFE OBSERVED IN THE
ORO CRUZ STUDY AREA

Common Name	Scientific Name
Birds	
Anna's hummingbird	*Calypte anna*
Ash-throated flycatcher	*Myiarchus cinerascens*
Barn owl	*Tyto alba*
Bell's vireo	*Vireo bellii*
Black-tailed gnatcatcher	*Polioptila melanura*
Black-throated sparrow	*Amphispiza bilineata*
Brewer's sparrow	*Spizella breweri*
Common nighthawk	*Chordeiles minor*
Common raven	*Corvus corax*
Gambel's quail	*Callipepla gambelii*
Great horned owl	*Bubo virginianus*
House finch	*Carpodacus mexicanus*
Ladder-backed woodpecker	*Picoides scalaris*
Loggerhead shrike	*Lanius ludovicianus*
Mockingbird	*Mimus polyglottos*
Mourning dove	*Zenaida macroura*
Phainopepla	*Phainopepla nitens*
Prairie falcon	*Falco mexicanus*
Red-shafted flicker	*Calaptes chrysoides*
Red-tailed hawk	*Buteo jamaicensis*
Rock wren	*Salpinetes obsoletus*
Sage Sparrow	*Amphispiza belli*
Say's phoebe	*Syornis saya*
Turkey vulture	*Cathartes aura*
Verdin	*Auriparus flaviceps*
White-throated swift	*Aeronautes sacatalis*
White-winged dove	*Zenaida asiatica*
Reptiles	
Black-collared lizard	*Crotophytus insularis*
Brush lizard	*Urosaurus graciosus*
Chuckwalla	*Sauromalus obesus*
Desert iguana	*Dipsosaurus dorsalis*
Desert tortoise	*Gopherus agassizii*
Rosy boa	*Lichanura trivirgata*
Side-blotched lizard	*Uta stansburiana*
Sidewinder	*Crotalus cerates*
Speckled rattlesnake	*Crotalus mitchelli*
Western whiptail	*Cnemidophorus tigris*
Western diamondback rattlesnake	*Crotalus atrox*
Desert spiny lizard	*Sceloporus magister*
Western banded gecko	*Coleonyx variegatus*
Zebra-tailed lizard	*Callisaurus draconoides*
Amphibians	
Red-spotted toad	*Bufo punctatus*

TABLE 24 cont.

WILDLIFE OBSERVED IN THE
ORO CRUZ STUDY AREA

Common Name	Scientific Name
Mammals	
Antelope ground squirrel	*Ammospermophilus leucurus*
Badger	*Taxidea taxus*
Big brown bat	*Eptesicus fuscus*
Bighorn sheep*	*Ovis canadensis nelsoni*
Black-tailed jackrabbit	*Lepus californicus*
Bobcat	*Lynx rufus*
Burro	*Equus asinus*
California leaf-nosed bat	*Macrotus californicus*
California myotis**	*Myotis californicus*
Canyon mouse	*Peromyscus crinitus*
Cave myotis- possible	*Myotis velifer*
Coyote	*Canis latrans*
Deermouse	*Peromyscus maniculatus*
Desert deermouse	*Peromyscus erimicus*
Desert kangaroo rat	*Dipodomys deserti*
Desert woodrat	*Neotoma lepida*
Desert pocket mouse	*Perognathus enicillatus*
Domestic dog	*Canis familiaris*
Gray fox	*Urocyon cinereoargenteus*
Kit fox	*Vulpes macrotis*
Long-tailed pocket mouse	*Perognathus formosus*
Merriam's kangaroo rat	*Dipodomys merriami*
Mexican free-tailed bat	*Tadarida brasiliensis*
Mule deer	*Odocoileus hemionus*
Pallid bat	*Antrozous pallidus*
Ringtail	*Bassariscus astutus*
Round-tailed ground squirrel	*Spermophilus tereticaudus*
Southern grasshopper mouse	*Onychomys torridus*
Spiny pocket mouse	*Chaetodipus spinatus*
Spotted bat- possible	*Euderma maculatum*
Townsend's big-eared bat	*Plecotus townsendii*
Western pipistrelle	*Pipistrellus hesperus*
Western mastiff bat	*Eumops perotis*
White-throated woodrat	*Neotoma albigula*

Source: Western Ecosystems, Inc.

* Possible bighorn sheep feces were observed in several mine adits near the proposed operational area, but presence has not been confirmed.

** Possible cave myotis guano was located in several Tumco Wash mines, but presence has not been confirmed.

myotis and Townsend's big-eared bat (guano) have also been detected within the operation area during baseline studies. The subspecies of Townsend's big-eared bat present in the area is probably *Plecotus townsendii pallescens*, one of two subspecies that occur in the vicinity.

In addition, 3 CSC species (the prairie falcon, black-tailed gnatcatcher and pallid bat) are at least seasonally present on-site. All of the above threatened and endangered species are discussed below at greater length.

Habitat Types

Wildlife habitats in and around the Oro Cruz operation area have been significantly influenced by historic mining activities, and more recently, by recreational and mine exploration activities. The effect of these activities has adversely influenced wildlife use, although some components of the wildlife community (e.g., mine-roosting bats) have benefitted.

The operation area can be divided into two distinct areas on the basis of existing human disturbance. Habitats in the Tumco Wash portion of the operation have been almost totally devastated by historic mining, but natural recolonization has partially restored many areas over the last 70± years. The portion of the operation area south of the saddle between the Tumco and American Girl Washes is relatively undisturbed, although evidence of historic roads and localized recent mine exploration are discernable.

Munz and Keck (1968) classified this portion of the California Desert into the creosote bush scrub type. This area was further differentiated into two distinct vegetation subtypes (Bamberg, personal communication, 1993): a shrub scrub, on the open, drier, flat alluvial fans and mountain slopes, and a mixed shrub/tree subtype in the canyons and washes. The desert pavement is well developed on extensive areas of the shrub scrub type, and the vegetative ground cover is almost non-existent below widely spaced low shrubs. Canyon vegetation reflects greater moisture availability, primarily via runoff from temporally brief precipitation events. These subtypes, and further divisions, are described in greater detail in the Vegetation section.

For purposes of discussing wildlife habitat, 6 major and minor habitat types on the proposed Oro Cruz operation area have been categorized, including shrub scrub, rocky slopes, washes, disturbed areas, mines, and impoundments. Excluding canyons, the first four habitats comprise approximately 90 percent of the site. Wildlife use of each type is presented below.

Shrub scrub. Shrub scrub is one of the major habitat types within the Project area, best developed in the American Girl Wash. Although this community is sparsely vegetated, this habitat type is the most widespread, productive habitat present. The other major habitats, rocky slopes and disturbed areas, support even less vegetation and, therefore, simpler wildlife communities. Species characteristic of this type include kangaroo rats, pocket mice, ground squirrels, loggerhead shrike, desert iguana, and zebra-tailed lizard.

Rocky slopes. Rocky slopes are a vegetational subset of the shrub scrub community. Like the latter type, this community supports a similar floristic composition, especially where soils are deeper. However, the crevices, burrows, and outcrops associated with these steep mountainous slopes and ridges provide a structural component for the wildlife community lacking in the shrub scrub types. As a consequence, this type provides burrowing habitat for rodents, denning habitat for canids and other terrestrial predators, nesting habitat for birds such as rock wrens, ravens, white-throated swifts, and great horned owls, and crevices for lizards and a few species of bats.

Canyons. The relatively high structural heterogeneity and number of microhabitats associated with canyon vegetation and physiography allow this spatially limited habitat type to support the highest biodiversity values of any local habitat. Following infrequent precipitation events, this habitat supports small pools of open water, a critical desert resource. These pools attract virtually all wildlife species requiring free water (as compared with metabolic water) and are a principal determinant of the distribution of many desert species. For example, desert mule deer are uncommon on the west slope of the Cargo Muchacho Mountains and are most frequently present following rainstorms. Open water also provides breeding habitat for the red spotted toad and for a profusion of invertebrates that form the prey base for wildlife ranging from lizards to birds and bats. Increased water availability also supports a relatively dense variety of shrubs and trees which provide hiding and thermal cover, nesting, denning, and foraging habitat, and wildlife movement corridors. Other wildlife species characteristically associated with this habitat include side-blotched lizards and western whiptails, mourning doves, verdin, black-tailed gnatcatchers, black-throated sparrows, house finches, and a variety of bats.

Disturbed areas. The mouth of Tumco Canyon was the site of the towns of Hedges/ Tumco, which experienced a discontinuous, 33 year period of mining from the 1880's to the 1920's (see the Cultural Resources section). As a result, habitats in a large portion of Tumco Canyon/Wash, including the proposed Oro Cruz operation area were destroyed or disturbed by mining and secondary activities. Disturbed areas vary widely in structure and present value to wildlife. Some disturbed areas, such as the tailings covering a large area of the wash and outwash plain, have significantly reduced wildlife values, and only after 70 years of vegetative colonization (primarily by creosote bush and annual plants) are these areas being used by any wildlife at all (primarily lizards and a few rodents).

Mines. In contrast to the disturbed areas discussed above, the extensive, abandoned mine workings have greatly expanded bat roosting habitat and are primarily responsible for the large numbers of California leaf-nosed bats present in the Cargo Muchacho Mountains. More recent mine exploration activities associated with the American Girl Project, involving road construction and drilling, have impacted previously disturbed and native habitats in mid- to upper Tumco Wash. Although these recent disturbances involved relatively minor acreage, impacts were widespread and some were significant (e.g., all entrances to the East Sovereign Mine, containing a moderate to large California leaf-nosed bat maternity roost and a pallid bat maternity roost,

were inadvertently bulldozed closed by road construction activities above them in summer 1990). Some of the mines in upper Tumco and the American Girl Canyons are used as desert tortoise hibernacula.

Impoundments. Historic mining activities left small concrete impoundments in mid-Tumco Canyon, one on either side of the wash, located approximately half-way up the adjacent slopes. These structures at least partially fill with runoff after precipitation events and may retain water for several months, much longer than the ephemeral wash pools. These sites are important watering areas for wildlife, including coyotes and foxes, bobcat, bats, and birds. Both sites also provide breeding habitat for invertebrates and the red spotted toad, whose local distribution has been expanded by these ponds.

Threatened, Endangered, and Candidate Species

The 9 Federal or State threatened, endangered, and candidate species which are present or potentially present, on the Oro Cruz operation area are discussed below.

Desert tortoise. The desert tortoise is a Federal and State threatened species. The Cargo Muchacho Mountains occur within Category 3 desert tortoise habitat, as defined by the BLM. Results of all tortoise surveys conducted in the Cargo Muchacho Mountains (Dimmitt, 1977; Berry, 1984; Patterson, 1982; Medica, 1988; LaPre, 1989; Bamberg, 1988; 1989, 1990, 1991a,b, unpubl. data; Bamberg and Hanne, 1991, 1992; Bamberg, et al. 1991; Thompson, 1991, 1992, unpubl. data; and Thompson, et al. 1991) indicate the proposed Oro Cruz operation area is tortoise habitat on the edge of the tortoise's general distribution in southern California and that, in suitable habitats, tortoises occur in relatively low densities of ≤ 10 tortoises per mi^2. Specific details on the results of tortoise surveys are discussed in detail in the BA prepared by BLM.

The proposed Oro Cruz operations area includes both occupied and unoccupied desert tortoise habitat. Unoccupied tortoise habitat includes (1) suitable, but unoccupied areas, and (2) presently unsuitable areas (e.g., some historically mined areas) that, given time, could again provide some value as tortoise habitat. Desert tortoise habitat that, if directly or indirectly impacted by mining, would require compensation was mapped in the vicinity of the proposed Oro Cruz operations area and included all categories of tortoise habitat described above, except non-habitats. Areas were mapped as tortoise habitat if they were now, or could be, useful and needed for some life history function, even if only seasonally.

Bell's vireo. A Bell's vireo was detected foraging in a Tumco Wash palo verde during May 1992 baseline surveys. There are 2 breeding subspecies of this bird, Arizona Bell's vireo, a Federal 3C and state endangered species, and least Bell's vireo, a Federal and state endangered species. The former subspecies is a summer resident along the Colorado River, approximately 13-17 miles to the east of the project area, where it primarily inhabits willow thickets with a seep willow understory. It normally nests in willows, mesquite, or other tall trees and shrubs, within 8 feet (usually 2-3 feet) of the ground. This type of habitat does not exist in the Oro Cruz area. Based on habitat affinities of the two subspecies, the proximity of the Colorado River, and the non-

vocalizing behavior of this solitary bird during the breeding season, it has been concluded in consultation with the U.S. Fish and Wildlife Service that this bird was a potentially vagrant Arizona Bell's vireo.

California leaf-nosed bat. The California leaf-nosed bat (*Macrotus*) is a Federal C2 candidate species and a California "Species of Special Concern" [CSC]. This bat is a member of a tropical family that only enters the United States in the southern parts of California, Arizona, and Nevada (Barbour and Davis, 1969). *Macrotus* in the Cargo Muchacho Mountains apparently do not migrate because of the availability of suitable summer and winter roosts, the latter almost exclusively provided by historic mine workings. *Macrotus* do not hibernate and because they can only poorly regulate their body temperatures, they rely on geothermally heated caves and abandoned mine tunnels (> 80°F) as winter roosts (Bell, et al. 1986). While roosts > 80°F may not be difficult to find in the desert during summer, caves and mine workings with lower temperatures are not used as winter roosts (Bradshaw, 1962, Brown, personal communication, 1991), and the species cannot tolerate temperatures in the 40's or 50's for more than a few hours (AGFD, 1988). Although maternity roosts are important, winter roosts are most crucial because they are more limiting. Present distribution and use of winter *Macrotus* roosts in the Cargo Muchachos has been significantly influenced by current mining, and to a lesser extent, by recreational activities, although winter *Macrotus* presence in the area is probably due to historic mining.

Winter numbers and distribution of *Macrotus* are dictated not only by the availability of suitable winter roosts, but also by the quantity, quality, and proximity of foraging habitat to roost sites. Approximately 1,000 *Macrotus* could be present during winter on the west side of the Cargo Muchachos. Approximately 648 and 735 *Macrotus* were detected emerging from the Cargo Mine on December 14, 1990 and December 16, 1991, respectively (Brown, 1991, 1992a), and several hundred are probably present in Tumco Canyon (approximately 100 were detected during December 1991 surveys).

There are few, if any, natural caves in the Cargo Muchacho Mountains that provide suitable winter roost sites. Historically, however, *Macrotus* could have been present in summer using shallow caves as roosts (Brown, personal communication, 1991). Nevertheless, it is highly unlikely that while suitable winter foraging habitat was available, *Macrotus* were present in the area in any sizable numbers until after local mine workings were created and abandoned. These mines were first operated in the 1860's (Love, 1974), with various periods of inactivity, so the bats could have been in the area at least 100 years (Brown, personal communication, 1991). After mine workings were abandoned, *Macrotus* numbers increased to a population that may have peaked in the mid-1980's. As discussed above, their distribution was determined by the distribution of suitable roosts and the quality of proximal foraging habitat that was undisturbed from historic mining activities. More recently, the 618 acres of habitat affected by Padre Madre and American Girl Canyon mining activities, additional minor (i.e., < 5 acres) acreage disturbed by Oro Cruz and American Girl Canyon mine exploration activities, and recreationist disturbances of roosts and foraging areas, have altered *Macrotus* habitat and roost use on the west slope of the Cargo Muchachos.

It is unknown, however, to what extent these disturbances have altered *Macrotus* numbers. Human disturbances could simply have forced a shift to adjacent undisturbed roosts and proximal foraging habitat without a numerical decline. An unknown number of *Macrotus* were killed, and a maternity roost was destroyed, when all entrances to the East Sovereign Mine were inadvertently closed by Oro Cruz exploration activities in summer 1990. Circumstantial evidence and a limited number of recaptures suggest that bats disturbed at roost sites may be accommodated in an adjacent roost. A few *Macrotus* banded in the Golden Queen Mine (Tumco Canyon) have been recaptured in the American Boy Mine (American Girl Canyon) and at other mines in Tumco Canyon (Brown, personal communication, 1991).

The availability of adequate foraging habitat may be a more important determinant of whether bats from adjacent areas can be accommodated in occupied roosts. For example, habitat within an existing roost may be adequate to support several times the number of bats present; however, if the amount of foraging habitat within the nightly cruising radius of the roost cannot support additional bats, surplus roost habitat is of little consequence. At present, little information is available on the carrying capacity of bat foraging habitat, the extent of nightly foraging bouts, or the distance that bats travel to adjacent roosts, with and without disturbances. Light-tagging studies have indicated that *Macrotus* forage exclusively among vegetation, usually in washes (Brown, personal communication, 1991). This would exclude the mountains and rocky slopes that compose perhaps 75% of the area immediately around known roosts. Preliminary results of a June 1992 study have determined that radio-equipped *Macrotus* foraged and night-roosted within three miles from their day roost in Tumco Canyon.

Most of the historic mine workings in Tumco Canyon are used by *Macrotus* to some extent, either as night, winter, summer, or maternity roosts. The Golden Queen Mine, proposed to be mined by Oro Cruz operations as the Queen open pit and subsequent underground methods, is the most important *Macrotus* roost in the wash and a major *Macrotus* winter and maternity roost in the Cargo Muchacho Mountains. December 8, 1990 and December 14, 1991 surveys located 120-150 and 77 leaf-nosed bats in the Queen, respectively (Brown 1991, 1992a). The apparent decline in 1991 numbers may be attributable to a summer flash-flood, which sealed the bottom (800 foot) level of the mine with mud. In 1990, 40 *Macrotus* were observed using this area. The flood probably entombed all bats using this drift at the time. Over 100 mother and juvenile bats used the Queen in 1989 (Brown 1989) and a minimum of 20 infants were produced in 1990 (Brown 1990).

Other important historic mines in Tumco Canyon used as either winter or maternity roosts by *Macrotus* include the Mesquite, Golden King, and Golden Crown. The historic Mesquite Mine is used as a winter, summer, and night roost, primarily by low numbers of males. Until 1992, *Macrotus* use of the Golden King was thought to be identical to use of the Mesquite Mine. However, on June 20, females with clinging young were observed in the mine indicating it was being used as a maternity roost. The Golden Crown is a winter and maternity roost used by moderate numbers of *Macrotus*. This mine is located

south of the wash itself and beyond any proposed mine facilities.

Loggerhead shrike. The loggerhead shrike is a Federal C2 species. In the study area, this bird is usually associated with taller wash vegetation or areas on the outwash plain supporting ocotillo or other large shrubs and trees. Principal prey species include small lizards, large insects, and nestling birds. One shrike was observed in the proposed Oro Cruz operation area in May 1992 and others are occasionally seen perched on trees and large shrubs on the outwash plain west of the Cargo Muchachos.

Pallid bat. The pallid bat is a CSC species. They are year-round residents in the Cargo Muchacho Mountains, hibernating in winter. They roost in rock crevices and a few use local mines. The Mesquite Mine is used as a maternity roost, as was the East Sovereign Mine before its entrances were inadvertently closed by mine exploration activities. Pallid bats feed on larger prey, such as sphinx moths, scorpions, and beetles, that are associated with desert wash vegetation. As such they have similar foraging areas and habitats as *Macrotus*.

Spotted bat. Little is known about the life history of spotted bats in California, a Federal C2 species. In other parts of its range, spotted bats roost in the cracks and crevices of high cliffs and emerge late in the evening to forage. During August 1989 surveys, Brown (1989) heard the audible subharmonic of a bat's echolocation call over Tumco Canyon, which she attributed to a spotted bat.

California mastiff bat. The California mastiff bat (*Eumops*) is a Federal C2 and CSC species that roosts in crevices in cliff faces or cracks in large rocks, habitats that are abundant in the Cargo Muchacho Mountains. There is a museum record for this species from 24 miles south of Paloverde along the Colorado River (Brown 1992b). Two western mastiff bats flew over the Cargo Mine on April 30, 1992 emitting characteristic, audible echolocation calls. These same calls were heard by bat researchers in Tumco Canyon in December 1991.

Cave myotis. The cave myotis is a Federal C2 and CSC species. Possible cave myotis guano was located in several Tumco Canyon mines, including a large, cave-like room just southwest of the Golden Crown, in August 1989 (Brown, 1989). The entrance to this mine has started to collapse.

Townsend's big-eared bat. Guano and possible guano from this species has been located in several Tumco Canyon mines (Brown 1989). Regarding the identity and status of Townsend's big-eared bat, 2 subspecies occur in the vicinity of the operation area. One of these is a C2 and CSC species and the other is a CSC species. There is presently no practical way of differentiating these subspecies by their guano.

Flat-tailed horned lizard. The flat-tailed horned lizard is a Federal C1 and CSC species whose critical habitat is fine sand into which the lizards burrow to avoid temperature extremes. Ants comprise almost the entire diet of this species. The closest records for this species occur to the south of Ogilby where the Imperial Dunes most closely approach the project area and where this species is relatively numerous (Turner and Medica, 1982). The only potential habitat for this species in the Cargo Muchacho Mountains is the sandy bottoms of the few washes draining the area.

Medica (1988) surveyed American Girl Canyon for this lizard, but found no lizards or any evidence of their presence.

In addition to the above threatened, endangered, and candidate species listed above, 3 CSC species, the prairie falcon, black-tailed gnatcatcher, and pallid bat, are at least seasonally present on-site. The prairie falcon occurs as a migrant in the area, the gnatcatcher is a breeder most common in wash vegetation, and pallid bats roost in several Tumco Canyon mines, including the Mesquite Mine.

Other High Interest Species

Mule deer, bighorn sheep, and feral burros are the large herbivores possibly present in the area. Evidence of all 3 species has been located in the Oro Cruz area during baseline surveys, although the latter 2 species are rare in the Cargo Muchacho Mountains.

Mule deer. Mule deer, known locally as burro deer, drift into the Cargo Muchachos during and following seasonally heavy rains when more widespread water availability permits more extended movements and habitat utilization. It is likely that the east slope of these mountains receives heavier deer use. The closest year-round deer ranges are along the Colorado River, to the east, and the Chocolate Mountains, to the northeast. Tracks and feces from low numbers of deer (groups of 2-5 animals) have been located in the upper portions of all western washes north of, and including, American Girl Canyon/Wash. Deer sign in the American Girl and Tumco Washes did not extend westward to proposed development areas.

Bighorn Sheep. The Cargo Muchacho Mountains were surveyed for bighorn sheep in 1969 and 1985 (Weaver and Mensch, 1969, Jorgensen, 1985). No sheep were observed during surveys and these mountains were considered outside of the sheep's known range. The closest occupied habitat is the Chocolate Mountains to the northeast, and the Colorado River to the east. No evidence of sheep were detected in the project area during baseline or prior wildlife surveys, with the exception that during bat surveys, Brown (1989) noted possible bighorn feces in several mine adits outside the proposed Oro Cruz operation area.

Feral Burros. The Cargo Muchacho Mountains are considered outside the normal range of feral burros. The closest occupied habitats are the Chocolate Mountains to the northeast, and along the Colorado River to the east. With the exception of a piece of old burro "biscuit" located in the upper northeast fork of Tumco Wash in May 1992, no biological surveys conducted in this mountain range have ever located evidence of burros.

Other Wildlife Groups

In addition to the species discussed above, and despite the harsh, low desert environment, the project area supports a wide variety of wildlife species. These species are discussed below by taxonomic group.

Herpetofauna. Several reptiles, including the side-blotched lizard, western whiptail, zebra-tailed lizard, and desert iguana, are a conspicuous part of the Tumco Wash wildlife community. Other less

conspicuous species include the desert granite lizard, chuckwalla, rosy boa, and speckled rattlesnake. While some of these species may be seen at any time of the year, most are more common and active during spring. Canyon habitats and adjacent, undisturbed uplands probably support a higher herpetofaunal diversity than other local habitats. Although lizards are common to abundant in Tumco Wash, even in disturbed areas, roadrunners were never observed in the area, although they are present around Gold Rock Ranch, approximately 5 miles to the west.

Red-spotted toads are common to abundant in Tumco Wash and other areas of the surrounding mountains in suitable habitats (moist washes and accessible impoundments), following precipitation events, and at night or early morning. These small toads apparently estivate most of the year and emerge after rains to breed and lay eggs in temporary pools. It is then a race between how fast the eggs metamorphose into tadpoles and adults, and how long the pool lasts. During this race, tadpoles are preyed upon by dragonfly larvae.

Small mammals. Black-tailed jackrabbits and 9 species of rodents, including the desert woodrat, antelope ground squirrel, pocket mice, kangaroo rats, and canyon mouse, have been documented in Tumco Wash habitats. All are relatively common species that compose the prey base for larger terrestrial and avian predators, from rattlesnakes to coyotes and red-tailed hawks. The wash-native upland ecotone, which supports the greatest forage availability and a high number of potential den/burrow sites, probably supports the richest small mammal community in the operation area.

Breeding birds. Twenty-three species of residents, breeders, or potential breeding birds have been documented on the Oro Cruz operation area. Additional species are present in the area adjacent to the proposed Oro Cruz facilities and others are seasonally present on-site as migrants and winter visitors/residents. Other species, such as Gambel's quail, white-winged doves, roadrunners, ladder-backed woodpeckers, etc., are common to abundant in adjacent areas, but have not been located on-site, probably because of insufficient habitat. The relatively high structural diversity provided by wash vegetation supports the highest bird richness and abundance values of any local habitat.

Raptors. The local raptor community is relatively sparse, reflecting a rich, but low density prey base characteristic of this low desert. No raptor nests were located in areas that would be affected by the Oro Cruz operation (in fact none were located at all). However, it is likely that a pair of great horned owls nested in or adjacent to Tumco Wash in 1992. These and barn owls are the 2 nocturnal raptors in the study area and red-tailed hawks and turkey vultures are the diurnal raptors. All these species (and ravens) hunt over at least portions of areas proposed for mine facilities.

Game birds. With the exception of mourning doves, no game birds are present within the Oro Cruz operation area. White-winged doves and Gambel's quail are at least seasonally present in American Girl Wash and surrounding areas, but have not been detected on-site.

Predators. The Oro Cruz operation area and surrounding habitats support a relatively rich, although not particularly abundant, predator community. Most species, such as badgers, ringtail, bobcat, coyote, and grey and kit foxes, range over large areas at night.

LAND USE

Imperial County covers an area of 4,957 square miles or 2,942,080 acres. Approximately 50 percent of County lands are undeveloped and under federal ownership and jurisdiction. Approximately 1/5 of the land is irrigated for agricultural purposes, most notably the central area known as Imperial Valley. The developed area where the County's incorporated cities, unincorporated communities, and supporting facilities are situated comprise less than 1 percent of the land. Approximately 7 percent of the County is the Salton Sea.

Although mining has been an important historic land use and economic stimulant in the region, the area of actual mining disturbance is relatively small. In addition to the two existing operations of the American Girl Project (Padre Madre and American Girl Canyon), there are two other major gold mining projects currently operating in the County. The Mesquite/VCR mine has been operating since 1986 approximately 16 miles northwest of the Oro Cruz property just north of Highway 78. The operation, owned by Santa Fe Pacific Gold Corporation, is approximately 20 air miles from the American Girl Project, and is the second largest gold producing operation in the State of California (approximately 200,000 ounces of gold per year). The Picacho Mine, operated by Chemgold, is a gold mine located in Imperial County about 12 miles northeast of the American Girl Project, near the Arizona border.

Local Land Use

The Oro Cruz area has supported two major land uses in the past: open space/recreation and mining/ prospecting. The project site lies within the Cargo Muchacho Mining District and, like other mining districts, has experienced several periods of activity by mineral interests, as expressed by evidence of surface prospecting and remnants of historical mining and ore processing facilities and townsites. Historically, most of the production from this area was associated with the underground mining of high-grade gold deposits and other industrial minerals. Prior to American Girl Project development in 1986, there was no large-scale gold production in the Cargo Muchacho Mining District since 1940. Approximately 65 percent of the area to be impacted by Oro Cruz development has been previously disturbed by various mining and exploration or other activities.

BLM Land Use Management

The proposed action would be situated on federal lands within the California Desert Conservation Area (CDCA). Other operations of the American Girl Project are located on lands involving a combination of Federal and private ownership. The site of the American Girl Project is designated a Class M (moderate) Multiple-Use Area under the CDCA Plan (BLM, 1980). As a result of the closure of American Girl Mine Road, certain uses of the area (e.g., camping, recreational vehicle use) have been

restricted. Recreation uses within the Oro Cruz area still include off- road vehicle use, rock hounding, and sightseeing. The Tumco/Hedges historic townsite in the mouth of the Tumco Canyon is a popular tourist attraction and camping area (see also the Recreation and Cultural Resources sections of this EIS). Class M management under Mineral Exploration and Development is addressed as follows:

> *Mineral exploration and development activities are generally compatible with other actions allowed in the class, subject to adequate mitigation of impacts on critical or sensitive resources or values.*

Imperial County Land Use Management

Imperial County also governs and controls land use planning and development of private lands through its General Plan. The General Plan is currently being updated. Elements to be included in the updated General Plan include:

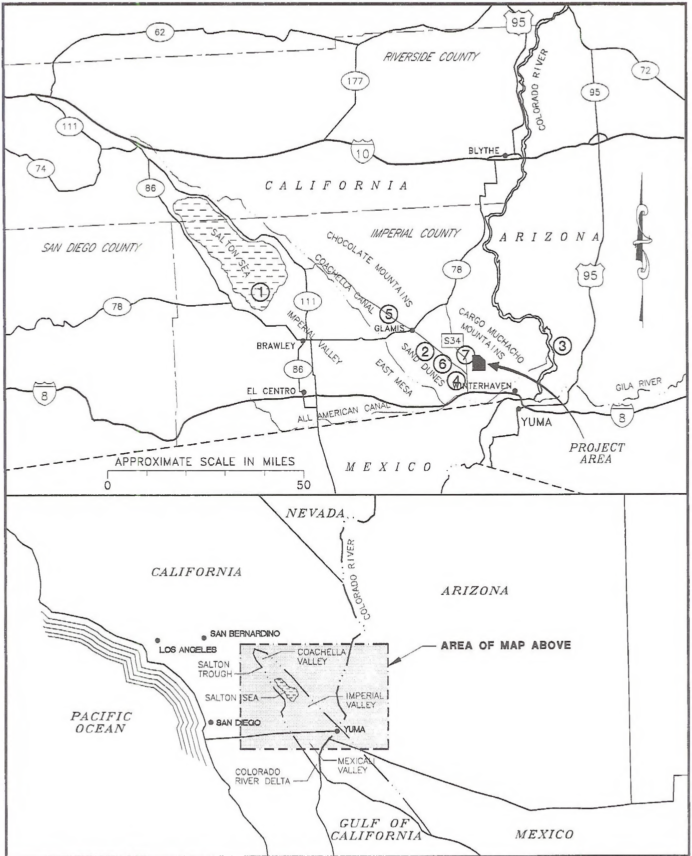
- *Land Use*
- *Circulation*
- *Housing*
- *Noise*
- *Seismic/Public Safety*
- *Conservation and Open Space*
- *Agriculture*
- *Geothermal and Transmission*
- *Water*

The project area is identified as "General Open Space" in the current Imperial County planning documents. The Land Use Element establishes a framework to guide future decisions regarding the use of the land and associated natural resources. The Open Space Element specifies various categories of open space use, such as preservation of natural resources, managed production of resources, and outdoor recreation. The current Land Use and Open Space Elements designate the American Girl Project area for recreation use. The updated General Plan would designate the Project area for recreational and open space uses (Mooney, personal communication, 1993). Mining is allowed through the multiple use concept incorporated into the General Plan and its nine Elements.

The American Girl Project sites have been zoned S (open space) by Imperial County. This designation allows for multiple use consistent with the Open Space Element of the General Plan. Mining is allowed as a "Conditional Use". Mining-related activities at Padre Madre and American Girl Canyon have been allowed through the approval of an Imperial County Conditional Use Permit (CUP). Because the Oro Cruz operation involves only Federal lands, an Imperial County CUP is not required for mining as proposed by AGMJV at Oro Cruz.

RECREATION

Recreation resources are available throughout Imperial and Yuma Counties. Information on regional and local recreational resources and uses was compiled from maps and literature supplied by public and private agencies. The BLM and County governments have primary control over most recreational resources in the area. Figure 33 shows the location of various recreational resources.



1. Salton Sea
2. Imperial Sand Dunes
3. Colorado River
4. Dunes Vista LTVA
5. North Algodones Dunes ACEC (WSA 360)
6. WSA 362
7. Tumco/Hedges Historic Townsite

FIGURE 33

LOCATION OF RECREATION RESOURCES IN ORO CRUZ AREA

Regional Recreation Resources

There are several important recreation resources within 50 miles of the project area. These include the Salton Sea, the Imperial Sand Dunes, the Colorado River and Long-Term Visitor Areas. Each is discussed below.

In 1901, Colorado River waters were diverted from Yuma, Arizona into Mexico and back into the Salton Sea basin for agricultural development. In 1905, failure of a diversion structure caused the Colorado to flow unchecked into the Imperial Valley for a 2-year period, thus creating the present Salton Sea. Agricultural drainage and run-off from the surrounding mountains now supply the Salton Sea; there is no outlet from the Sea and water is removed only by evaporation. The Salton Sea National Wildlife Refuge, approximately 50 miles from the American Girl Project, was established in 1930 by a Presidential Proclamation. Because of flooding by the Salton Sea, only about 2200 manageable acres remain from the original 35,000 acres. Recreation opportunities include wildlife observation and photography, hiking on designated trails, waterfowl hunting, and fishing.

The Imperial Sand Dunes are the largest mass of sand dunes in California. This dune system extends for more than 40 miles along the eastern edge of the Imperial Valley agricultural region in a band averaging five miles in width. The east edge of the dunes is less than 10 miles west of American Girl Project. The mild climate between October and May attracts tens of thousands of off-highway vehicle (OHV) enthusiasts to the area. In order to preserve a portion of the dunes in an undisturbed state and to protect sensitive plant and animal species, BLM established the North Algodones Dunes Area of Critical Environmental Concern (ACEC) in the dunes immediately north of State Highway 78 (see Figure 33). The ACEC is a BLM Wilderness Study Area (WSA360) and has also been designated a National Natural Landmark by the National Park Service. Another area in the central dunes south of Glamis/Gecko has also been designated as a Wilderness Study Area (WSA 362).

The Colorado River serves as the border between California and Arizona east of the proposed Oro Cruz site. The River provides a wide variety of recreational opportunities including fishing, boating, swimming, hiking, water skiing, and sightseeing. The Pichacho State Recreation Area and the Imperial National Wildlife Refuge, both on the Colorado River, are within 20 air miles of the American Girl Project site.

The BLM has established eight Long-Term Visitor Areas (LTVAs) to meet the long-term needs of winter visitors to the southeast California/southwest Arizona region (including Imperial and Yuma Counties). Visitors may camp in these LTVAs for up to seven months. The areas designated as LTVAs were chosen because of their past popularity with winter visitors and because access roads have been developed and facilities are available nearby. The nearest LTVA to the American Girl Project site is the Dunes Vista LTVA, near the intersection of Ogilby Road and Interstate 8, about 10 miles from American Girl mining operations. In comparison to other regional LTVAs, the Dunes Vista LTVA is used less frequently.

Local Recreation Resources

Recreation activities in the American Girl Project area have traditionally included sightseeing, off-road vehicle use, rock hounding, camping, and some hunting. Because of the relative remoteness of the site, recreation use has been moderate to light. Recreational activities do not occur in the American Girl Canyon operation area as a result of the BLM's closure of American Girl Mine Road (Federal Register, Vol. 52, No. 29). A security gate on American Girl Mine Road restricts public access to the American Girl Canyon and Padre Madre mining operations and facilities. This security gate would also restrict access to Oro Cruz operations.

Many square miles elsewhere in Cargo Muchacho mountains see few visitors, or none at all, for days or weeks at a time. BLM data from its Tumco sampling area in the early 1980s suggest that not more than 15,000 visitor days a year could be attributed to the Cargo Muchacho region. This places the use at approximately 125 visitors per square mile per year.

However, the Tumco/Hedges historic townsite in the mouth of Tumco Canyon near the proposed Oro Cruz operation is a relatively popular tourist attraction and camping area. The townsite is listed in many books featuring ghost towns and rock hounding areas. Additionally, the townsite has been designated by the California State Department of Parks and Recreation as California Historic Landmark No. 192. BLM does not keep specific recreational use figures on the area; BLM estimates that on most winter weekends there are usually 6 to 10 campers in the canyon. Day use of the area is more extensive. BLM estimates that a majority of the 4500 winter visitors (campers) to the LTVAs in Imperial County as well as several hundred local residents and other tourists visit Hedges/Tumco each year.

The San Diego Council of Gem and Mineral Societies holds their "Rock Round-Up" at the Gold Rock Ranch, about 1.4 miles from Hedges/Tumco, each winter. This event attracts several thousand campers and rockhounds.

VISUAL RESOURCES

The American Girl Project is located in a desert landscape of scant rainfall, excessive heat, and high winds. It is a barren landscape of basin and range topography, sparse desert shrub vegetation, expansive views, exceptional light quality, and sparse development activity. The project site is within the Cargo Muchacho range, one of several small, rugged mountain ranges scattered throughout the deserts of southern California. The Cargo Muchachos are 8 miles long and 3 miles wide and trend in a northwest-southeast direction. The range consists of jagged, low-elevation peaks (the highest point is 2,129 ft) and talus rock slopes, which are a dull garnet red.

To the north and east of the project area are mid-distant views of the Cargo Muchacho range ridgeline and outer perimeter foothills. To the west are expansive views of Pilot Knob Mesa, with the Imperial Sand Dunes in the distant background. Looking south, the views are foreshortened by the foothills of the Cargo Muchachos. Looking east, views are somewhat foreshortened by the upper reaches of valleys and canyons and the ridgeline of the Cargo Muchacho range.

The Cargo Muchacho range has long been an area of mining activity (see Land Use and Cultural Resources). Considerable surface disturbance and mining remnants are visible throughout the project vicinity.

Visual Resource Management within the CDCA

The CDCA Plan (BLM, 1980) designated the American Girl Project area (including the Oro Cruz area) as a Multiple Use Class M area. Multiple-Use Class M (Moderate Use) is based upon a controlled balance between higher intensity use and protection of public lands. This class provides for a wide variety of present and future uses such as mining, livestock grazing, recreation, energy and utility development. Class M management is also designed to conserve desert resources and to mitigate damage to those resources caused by permitted uses.

With respect to visual resource management, the CDCA provides the following guidelines:

- *The appropriate levels of management, protection and rehabilitation on all public lands in the CDCA will be identified, commensurate with visual resource management objectives in the multiple-use class guidelines.*

- *Proposed activities will be evaluated to determine the extent of change created in any given landscape and to specify appropriate design or mitigation measures using BLM's contrast rating process.*

Class M areas within the CDCA are essentially equivalent to Class III lands within the BLM Visual Resource Management classification system.

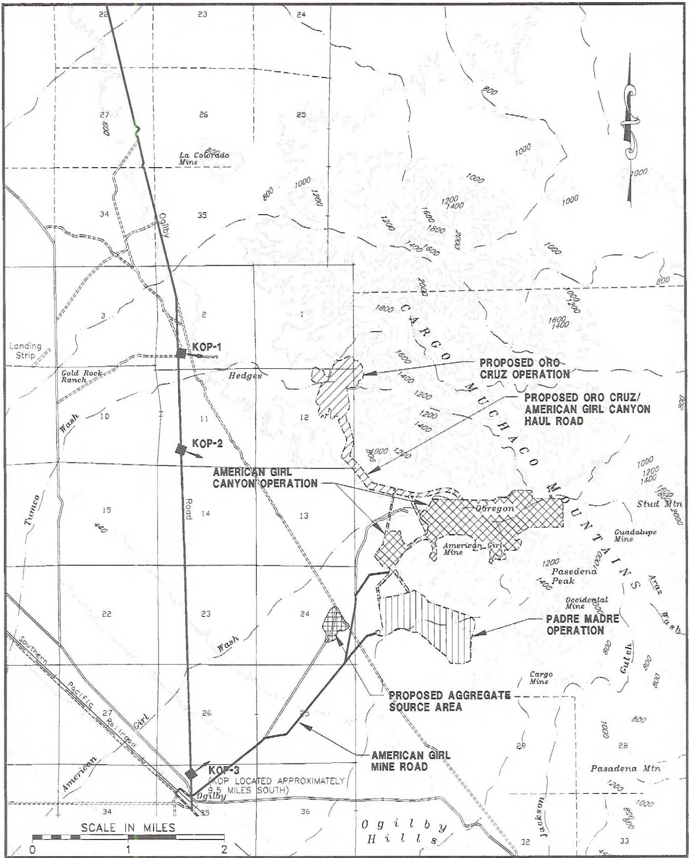
Contrast Rating

Contrast Rating is a systematic process established by the BLM as a part of the Visual Resource Management guidelines for analyzing the potential visual impacts of proposed projects and activities. The proposed operation features and characteristic landscape features from critical viewpoints are described in terms of the basic design elements of form, line, color, and texture. These descriptions form the basis for measuring the degree of visual contrast between a proposed project and the existing landscape. Contrasts are rated as none, weak, moderate, or strong. This assessment process provides a means for determining visual impacts and for identifying measures to mitigate these impacts.

Key Observation Points

Key Observation Points (KOPs) were established (see Figure 34) to represent typical views of the American Girl Project area:

- *KOP-1 - Intersection of Gold Rock Ranch Road and Ogilby Road. KOP-1 is located at the intersection of Gold Rock Ranch Road and Ogilby Road (County Road S34) approximately 1.5 air miles west of the Oro Cruz site. Gold Rock Ranch Road provides access to Gold Rock Ranch, a small commercial facility consisting of a curio shop, recreational vehicle campsites, one residence, and about 10 permanent mobile*



KOP-2 KEY OBSERVATION POINT

FIGURE 34

LOCATIONS OF KEY OBSERVATION POINTS (KOP's)

homes. The camping area is used by visitors, most of whom come from the north to the dry desert climate during the winter months. Ogilby Road extends perpendicular to Interstate 8, skirting the western base of the Cargo Muchacho range. This paved two-lane road serves as a connector between Interstate 8 and State Highway 78. Residents and recreational visitors traveling to and from Gold Rock Ranch, Glamis, Blythe, and Interstate 8 are the principal users of Ogilby Road.

The views toward the Oro Cruz site consist of the expanse of flat desert floor of Pilot Knob Mesa in the foreground and the Cargo Muchacho Mountains in the background. The gentle rise of the mesa toward the Cargo Muchacho Mountains leads the eye through the middle ground, where the desert floor meets the foothills, and up to the rugged mountain ridgeline. The light-colored desert soils of Pilot Knob Mesa contrast with the dark garnet color and angular texture of the Cargo Muchacho range. The desert vegetation provides a transition between the light desert floor and the dark mountains. Historic mining disturbances are visible from KOP-1. Based on proposed configuration and layout, there would be direct views of the Oro Cruz operation site from KOP-1.

- ***KOP-2** - Direct View of American Girl Canyon Facilities from Ogilby Road. KOP-2 is located within a continuous observation zone that demonstrates the varying degree of American Girl Canyon operation visibility from Ogilby Road. Intervening terrain and the location of a portion of the project behind two knolls along the north-facing canyon wall obscures a portion of the operation. American Girl Canyon operation elements directly visible from this KOP include the main pit, waste rock dump, and the leach pad. Additionally, historic mining disturbances are visible from KOP-2.*

As in KOP-1, desert vegetation provides a gradual transition from the horizontal surface of the desert floor in the foreground to the vertical slopes of the distant mountains. The dark green hues of ironwood and creosote bush integrate the light browns and tans of the desert soils with the dense amber and garnet hues of the Cargo Muchachos.

- ***KOP-3** - Ogilby Road at Interstate 8. The overpass of Ogilby Road and Interstate 8 is located approximately 8 air miles south -southwest of the Oro Cruz site. Interstate 8 extends in a east-west direction and is a major travel route connecting the Los Angeles basin to the Phoenix metropolitan area. This viewpoint is near the Dunes Vista Long Term Visitor Area (see the Recreation section). Foreground views from the I-8 overpass are of the broad outwash plain of Pilot Knob Mesa, the southern portions of the Cargo Muchacho range, and the Ogilby Hills. Distant views consist of the northern portions of the Cargo Muchacho range and Pilot Knob Mesa to the north, the Algodones Dunes to the west, Pilot Knob Mesa to the south, and the City of Yuma, Arizona, to the east.*

Because of the distance, the form, line, color, and textural contrasts of the project area are weakened. The dark hues and rough angular form of the mountains are softened by atmospheric haze, which causes detail to fade. The Oro Cruz site is not distinguishable from this KOP; however, the Padre Madre heap leach is visible on clear days. Historic mining disturbances are clearly visible from KOP-3. For example, the Kyanite Hills (located immediately west of the existing Padre Madre heap leach) are a major visual mining disturbance from KOP-3.

SOUND

Sound level is typically measured in units of A-weighted decibels (dB(A)) using a logarithmic scale which is "frequency-weighted" to the sounds within audible range. A 10 dB(A) increase in sound is approximately equal to a doubling in the human perception of loudness. A 5 dB(A) increase in average sound is considered to be clearly perceptible, and an impact to noise-sensitive properties (Harris, 1991).

Human hearing encompasses the sound range from 5 to 140 dB(A), although lower and upper limits vary. For the reader's frame of reference, normal speech occurs between 50 and 65 dB(A) and a vacuum cleaner at 3 meters is approximately 70 dB(A) (Harris,1991).

"Sound" is referred to and regulated as "noise" (any disagreeable or undesired sound). Noise measurements are typically averaged over time to account for fluctuations in noise levels. The energy equivalent noise level, Leq, is used to express the average noise intensity over a given time. A second term, Ldn (day-night equivalent sound level), is used to account for human sensitivity to nighttime noise levels. This term divides a 24-hour period into daytime (7 a.m to 10 p.m.) and nighttime (10 p.m. to 7 a.m.), and weights the nighttime noise level 10 dB higher than the daytime noise level. In the Ldn term, the 10 dB(A) nighttime adjustment is made to the hourly Leq's (California Office of Noise Control).

Criteria for Noise Evaluation

California noise control standards for various land use categories are presented in Table 25.

Description of Background Noise

Monitoring of ambient noise levels at the proposed Oro Cruz site has not been conducted to date. The sources of manmade noise currently affecting the proposed project area are: 1) the existing American Girl Canyon and Padre Madre operations (including blasting, crushing, sonic guns, and haul truck traffic); 2) exploratory drilling operations; 3) occasional light aircraft overflights; and 4) periodic haulage along existing roads, primarily related to other mining activities.

Natural sources of noise include wind, rain, thunder, insects, birds, and other wildlife. Available data indicate that noise levels in natural environments such as the project area may range from 15 to 45 dB(A), depending on the noise source.

TABLE 25

CALIFORNIA OFFICE OF NOISE CONTROL LAND USE COMPATIBILITY GUIDELINES

		Community Noise Exposure Ldn (dB)		
Land Use Category	Clearly Unacceptable [1]	Normally Unacceptable [2]	Conditionally Acceptable [3]	Normally Acceptable [4]
Residential - low density	75	70-75	55-70	50-60
Residential - Multi-family	75	70-75	60-70	50-65
Transient lodging	80	70-80	60-70	50-65
Schools, libraries, churches, hospitals	80	70-80	60-70	50-70
Playgrounds, neighborhood parks	72.5	67.5-75	---	50-70
Golf courses, water recreation, cemeteries	80	70-80	---	50-75
Industrial, utilities, agriculture	--	75-85	70-80	50-75

[1] - Clearly unacceptable - new construction should not be undertaken.
[2] - Normally unacceptable - new construction should be discouraged. If construction does proceed, acoustic analysis is to determine the insulation needed, if required.
[3] - Conditionally acceptable - new construction should be undertaken only after acoustic analysis and installation of noise insulation. Conventional construction with closed windows and fresh air supply systems or air conditioning will normally suffice.
[4] - Normally acceptable - land use satisfactory, buildings need no special noise insulation

(Source: California State General Plan Guidelines, App. A.)

CULTURAL RESOURCES

Cultural resources are fragile and nonrenewable remains of human activity, occupation, or endeavor, reflected in districts, sites, structures, buildings, objects, artifacts, ruins, works of art, architecture, and natural features that were of importance in human events. These resources consist of (1) physical remains; (2) areas where significant human events occurred - even though evidence of the event no longer remains; and (3) the environment immediately surrounding the actual resources. Cultural resources, including both prehistoric and historic remains, represent a continuum of events which are discussed in terms of prehistoric, ethnohistoric, and historic values.

For purposes of this document, prehistoric cultural resources represent Native American use of a region prior to the influences of European contact. The Native American utilization of a region after the influence of European contact is the ethnohistoric period, and historic resources are those representing European/American exploration and settlement.

Few published archaeological projects have been undertaken in the Cargo Muchacho Mountains. Those that have are confined primarily to the west side of the Cargo Muchacho Mountains along Tumco Wash (Burney, et al. 1993; Connell, 1979; Elling and Van Wormer, 1989; Hatheway and Burney, 1991a and 1991b) and the American Girl Wash (Hector and Van Wormer 1987 and 1988). These studies have been in response to gold mine development (e.g., the American Girl Project) occurring in the area and focus, for the most part, on historic mining resources. Results of studies are discussed below.

Prehistoric Cultures and Resources

Generally, six successive cultural patterns are recognized for the Colorado Desert over the past 12,000 years. These are: (1) the Malpais or Early Man; (2) the San Dieguito; (3) the Pinto and Amargosa; (4) the Patayan (prehistoric Yuman); (5) the Historic Yuman; and (6) the Historic Euro-American. The first four patterns involve prehistoric resources:

- *The Malpais period is represented by archaeological materials hypothesized to date from approximately 12,000 to 50,000 years ago.*
- *The San Dieguito period (Ezell, 1984 and Warren, 1967) dates between 7,000 and 12,000 years ago. This time period is characterized by small mobile bands of hunter-gatherers exploiting small and large game animals and seasonally available wild desert plants.*
- *The Pinto and Amargosa Periods are comprised of the Pinto Complex dating between 7,000 and 4,000 years ago and the Amargosa Complex dating between 4,000 and 1,000 Years ago. They are regional manifestations of the Desert Culture prevalent in the Great Basin and California Deserts representing specializations of a diversified hunting and gathering tradition.*
- *The hallmark of the Patayan period is the presence of pottery on the lower Colorado River approximately 1,200 years ago. In addition, techniques of flood plain agriculture were introduced, and burial practices changed from extended inhumations to cremations in ceramic vessels (e.g., Hohokam cultural traits). Small mobile groups living in dispersed seasonal settlement were scattered along the Colorado River floodplain.*

Prehistoric American Indian sites in the general vicinity of the project area consist of open lithic (i.e., chipped stone tools and debris) scatters and open ceramic scatters, including "pot drops," or small discrete locations of dense pottery sherds. Ceramic wares include Colorado Beige, Tumco Buff, Tumco Red-On-Buff, and Salton Buff (McGuire and Schiller, 1982).

Ethnohistoric Cultures and Resources

The ethnohistoric Yuman period begins with the first historic accounts of the traditional inhabitants of the lower Colorado River made by Spanish and American explorers. Kroeber (1920) conducted the first professional anthropological study of Native American peoples living in the lower Colorado River area while numerous additional studies have followed.

No less than 12 distinct Native American cultural groups inhabited the area of the California deserts. These groups represented two major linguistic divisions: the Yuman language family of the Hokan stock and the Numic and Takic subfamilies of the Uto-Aztecan family.

In the general vicinity of the Cargo Muchacho Mountains and along the lower Colorado River are the Mojave, Maricopa or Halchidoma (now Chemehuevi), Quechan or Yuma, and Kamia who speak Yuman languages. The Desert Cahuilla further north of the Cargo Muchacho Mountains spoke a Uto-Aztecan language (Bean, 1978; Bean and Saubel, 1972). The Quechan are culturally and linguistically related to the Cochimi, Cocopa, Halyikwamai, Kohuana, Kamia, and Diegueno (Dumeyaay), Kiliwa, Walapai, Havasupai, Yavapia, Halchidoma, Maricoa, and Mojave. They also shared many cultural and technological aspects with the Shoshonean-speaking Cahuilla and Chemehuevai to the north and west (Forde, 1931).

The Quechan (i.e., the Fort Yuma Native American Reservation north of Yuma, Arizona), Halchidoma, and Mojave practiced agriculture along the lower Colorado River supplementing their diet with fishing, hunting, and collecting wild plants. It has been estimated that their agricultural pursuits represented approximately 50 percent of their diet. When crops were poor, however, it was common for these Colorado River tribes to seek edible wild plants along the river and desert plants as far as 5-10 km inland (Knack, 1981; Pendleton, 1984).

According to Kroeber (1974) the Quechan gathered mesquite as far north as the Big Maria Mountains and the Riverside Mountains approximately 80 to 100 miles to the north of Yuma. In addition, the lower Colorado tribes, including the Quechan, were known for their long distance war parties comprised of 100 men or more.

The Mojave maintained major rancherias along the western side of the Colorado River between Laguna Dam to the north and San Louis on the U.S side of the Mexican border. Ethnographers recorded between four and six rancherias including Xuksil near Pilot Knob, villages near Winterhaven and Yuma, and the "Sunflower seed Eaters" along the Gila River southwest of the Laguna Mountains (Stone, 1991).

West of the Colorado River the desert basins and mountains were used intermittently by the Serrano, Cahuilla, and Colorado River tribes. The Kamia (Kam-me-i), a small group who spoke a subdialect of Diegueno, resided along the Alamo and New Rivers south of the Salton Sea. Effective floodwater farming was practiced when overflows occurred. Salt and various crops were traded to the Diegueno in exchange for agave and acorns. Neighbors to the Kamia were the Cahuilla on the north, the Kokopa (Cocopa) on the southeast, the Diegueno on the west and the Yuma or Quechan on the east. The Kamia

were friendly with the Quechan settling at Algodones near Pilot Knob after a decline in spring flooding reduced the feasibility of agriculture along the delta overflow channels (Gifford, 1931; Warren, et al. 1981).

When harvests were poor, stored foods were exhausted, or other serious threats to the food supply, lower Colorado River Native American peoples would intensify their use of the desert and nearby mountains to exploit wild floral and faunal resources. Various wild food resources are found along washes including wolfberries, grasses, greens, and legumes from mesquite, palo verde, and ironwood trees. Yucca and cholla and prickly pear cacti were available in upper bajadas and canyons of the nearby mountains ranges (Stone, 1991).

The Cargo Muchacho Mountains could have provided these Native American groups with a variety of subsistence and medicinal plants, old homesites, religious areas, transportation corridors, (i.e., trails), hunting areas, and other uses of this rugged mountainous area. An inquiry was made about 10 years ago with then Tribal Chairman, Paul Menta of the Quechan Indians about past and present uses of the Cargo Muchacho Mountains with inconclusive results (von Werlhof, 1981).

Historic Resources

Many historic features occur in the Cargo Muchacho Mountains resulting from the Spanish, Mexican and American miners who once mined for gold there. Mineral wealth was first reported in the region by Spanish explorers. Originally known as the Sierra de San Pablo, gold ore was discovered in the Cargo Muchachos by Father Francisco Garces in 1776. This was probably the earliest discovery of gold in the present State of California (San Diego Union, January 30, 1938; Brown and Taylor, 1867; Spaulding, 1885). The Spanish established a short-lived mission and presidio at Yuma from 1780 to 1781. Rich placer deposits near present-day Laguna Dam were worked by these early settlers as well as surface ore deposits in the Sierra de San Pablo in the area of present-day Jackson Gulch and the Madre Valley (Henshaw, 1942).

With the conquest of Mexico by the United States, and consequent establishment of Fort Yuma on the Colorado River, American miners began to enter the Colorado Desert (Morton, 1977). The Cargo Muchacho Mining District was first established in 1862, although it was reestablished and redefined several times in later years (San Diego Union November, 23, 1893). Development of the Cargo Muchacho Mining District differed slightly from the typical California mining camp.

The period from 1862 through the later 1870s was characterized by small-scale prospecting and mining not unlike that of the Spanish era. Development of the region was retarded due to the inhospitable environment and limited access. The most important mines at this time were the Padre and Madre claims, located on the eastern edge of the Madre Valley (San Diego Union, January 23, 1983). The Madre and Padre claims were first formally recorded by Willima Putler, James J. Spauer, and Edward Niel in April 1875 (Miscellaneous Records).

In 1877, the Southern Pacific Railroad completed its transcontinental line. The link from Yuma to Los

Angeles ran within a few miles of the Cargo Muchachos. By 1880, the railroad had established a siding and section headquarters at Ogilby, approximately 2.5 miles southwest of the Padre Mine (San Diego Union, date unknown). A railroad employee stationed at Ogilby, Peter Walters, prospected a valley of the Cargo Muchachos located three miles north of the Madre Mine. His discoveries started a rush into the area (Connell, 1979).

Of Swedish descent, Walters had a permanent residence in Santa Monica, California. He filed his first claim, the Grand Mogul, in November 1883 (San Diego Union, November 23, 1883). He soon filed a series of additional claims that included the Little Mary in January 1884, and the Black Butte, Three Sisters, Little Pete, Alice Mary, and Carbonate in March of the same year (San Diego Union, January 25, 1884; March 19, 1884). Assays of ore from the Black Butte were valued at $130 per ton. Walters personally realized $114 after working a "sack" of ore with an arrastra (Connell, 1979).

News of the discovery brought a flood of prospectors to the Cargo Muchachos. Between 1884 and 1886 numerous claims were filed. A mining camp known as Gold Rock soon developed at the site of Walter's strikes near the proposed Oro Cruz location (Connell, 1979). Establishment of Gold Rock brought accelerated development of the region. As with the earlier works, rich ore at Gold Rock was on or near the surface and easily recovered (Connell, 1979). Continued rich assay reports brought substantial outside investment. In the late 1880s, approximately 20 major mines were operating at Gold Rock.

By the end of the 1880s, surface ores were exhausted. Faced with increasingly greater expenditures to pursue deep shaft hard rock mining, Gold Rock operators sold out. Walters sold his claims to Hedges, Fuller, and Company of Sioux City, Iowa in 1893. The new owners formed the Golden Cross Mining and Milling Company and soon controlled the remaining Gold Rock Claims (Love, 1974). Gold Rock camp was renamed Hedges and became a company town of Mexican miners with about 400 inhabitants. By 1900, a 100 stamp mill and cyanide plant had been constructed (Elling and Van Wormer, 1989). The town was renamed Tumco in 1910 for the Trumble United Mines Company.

Modernization also affected operation of the older mines in the Cargo Muchachos. The period around 1900 saw investments of capital, installation of modern equipment, and development of new mines. Mining the southern Cargo Muchachos during this time centered around the Padre Madre, American Girl, Pasadena, Blossom, and Cargo Muchacho mines.

The Cargo Muchacho mines remained active in spite of periods of abandonment through World War I. By 1920, however, all major mining had ceased. In 1936 there was a renewal of mining in the Cargo Muchacho district which lasted until the early part of 1940. During this "boom" the American Girl, Blossom, Cargo Muchacho, and Padre Madre mines were in continuous operation, in addition to the Sovereign and Golden Queen mines in Gold Rock Canyon (Sampson and Tucker, 1942). By 1940 all major mining activity had once again ceased in the Cargo Muchacho Mountains. Mining efforts began again in the district in the 1980s (e.g., the American Girl Project).

Several cultural resource inventories and other projects have occurred in the Cargo Muchacho

Mountains that have dealt with historic, primarily mining-related resources. A characterization of mining resources in the project area by Olsen and Portillo (1990) accurately portrays the Hedges/Tumco mining community and other mining activities in the American Girl Canyon/Wash (i.e., Obregon, American Girl Mine, American Boy Mine):

> *Historic mining remains include evidence of all forms of mining technology. Commonly encountered are remains of hand mining, hydraulic mining, hardrock mining, as well as exploratory work leading to various types of mining. Types of resources commonly encountered include water diversion, reservoir and canal systems, roads and trails. Structural remains represent a variety of purposes, some directly related to mining operations or from community based support services, such as hotels, bunkhouses and transportation systems. Those remains directly related to mining include mines and support structures, smelting facilities, etc. Some of the more permanent mining developments included schools, churches, cemeteries and other aspects of socioeconomic behavior.*

Recent Investigations

In 1988, Brian Mooney and Associates conducted a 1,200 acre survey encompassing Tumco Wash and the proposed Oro Cruz development area. This work identified five prehistoric sites and the historic mining town site of Hedges/Tumco that consisted of over 179 features grouped into nine loci. The Hedges/Tumco historic town site consists of artifacts, industrial features, and structural remains of a mining community that cover approximately 120 acres (Elling and Van Wormer 1989).

Investigations conducted in 1992-93 have concluded that the Hedges/Tumco Historic Townsite is eligible for NRHP listing (Burney, et al, 1993). The Burney study divided the Hedges/Tumco area into 16 zones based on activity groupings. The eastern end of the townsite is comprised of zone 6 (the Golden Queen mine complex) and zone 10 (the Golden Crown mine complex). Zones 6 and 10 are within the proposed Oro Cruz operational area. Cultural resources within these areas include pits, glory holes, shafts, adits and remains of headframes, ore bins, and a hoist house.

Within the proposed haul road corridor, prehistoric pottery and several historic features and artifacts were recorded during the cultural resources survey. The pottery was on the gound surface and collected in its entirety. The haul road historic features were primarily construction-related and included a rock retaining wall and rock foundation with evidence of nearby mining. These haul road resources are not considered by BLM as eligible for NRHP listing. The inventory of the proposed waste rock dump site did not yield any cultural resources. Impacts to all identified cultural resources within the proposed Oro Cruz operational area are discussed in Chapter 4 of this EIS.

TRANSPORTATION

The eastern portion of Imperial County is served by a system of county roads, state highways, and Interstate Highway 8. The American Girl Project is located approximately 15 miles northwest of Yuma, Arizona, and 40 miles east-northeast of El Centro, California. All components of the project, including the proposed Oro Cruz operation, can be reached by exiting Interstate 8 at the Ogilby exit, going north on Ogilby Road (County Road S34) approximately 3.5 miles to Ogilby, and traveling northeast approximately

2 miles on an improved county gravel road (known locally as American Girl Mine Road). This access route is used by almost all current employees and mine suppliers.

Ogilby Road is the main north-south link between Interstate 8 and State Highway 78. Historically, American Girl Mine Road provided access to a route of travel across public lands through American Girl Canyon. As noted above, the route of access has recently been closed to through traffic for public safety.

The proposed Oro Cruz operation area can currently be reached by dirt roads which initiate near the intersection of Ogilby Road and Gold Rock Ranch Road. These dirt roads have traditionally been used for recreational purposes (e.g., sightseeing in the Tumco/Hedges area and rockhounding).

Traffic volumes in the area decrease with distance from the major communities and irrigated agricultural areas. Traffic in the eastern portion of Imperial County is significantly higher in the winter months because of the high volume of recreation travelers. This traffic is most intense in the first three months of the year. Traffic volumes along State Highway 78 immediately east of Ogilby Road averaged 1450 vehicles per day in 1992; traffic volumes immediately west of Ogilby Road averaged 1250 vehicles per day. According to Caltrans information, traffic volumes on Highway 78 decreased through the mid-1980s, but have increased in recent years. Traffic volumes along Interstate 8 averaged 10,000 and 10,300 immediately west and east, respectively, of the intersection with Ogilby Road in 1992.

The Southern Pacific Railroad runs in a northwest to southeast direction approximately 2 miles southwest of the project area.

SOCIOECONOMICS

Various factors may influence the location and magnitude of potential socioeconomic impacts. These include:

- *the location of and access to the ore body,*
- *the residence areas for people working at the mine,*
- *the rate and magnitude of in-migration, if any,*
- *the availability and location of housing for employees,*
- *the capacity and condition of existing local services and facilities,*
- *the number and location of people directly/indirectly affected economically by the mine, and*
- *the ability of community residents and local government to deal with change.*

The existing socioeconomic environment will be described as a basis to analyze these factors in the impact analysis section of this EIS.

Imperial County, originally part of San Diego County, was founded in 1907. The area was visited as early as 1540 by Hernando de Alarcon, discoverer of the Colorado River. It was further explored by Spanish explorers and Catholic friars. White settlements existed along the Butterfield State Route as early as 1858, but no real development took place until water was brought into the area in 1901.

Yuma County is located in extreme southwest Arizona, bordering the Colorado River and the California border to the west, Mexico to the south, Maricopa and Pima Counties to the east, and La Paz County to the north. The city of Yuma is considered to be a gateway to the southwestern United States because of the Yuma Crossing, the only land route across the Colorado River into California within the region. From 1540 to 1854, Yuma was under the flags of Spain and Mexico, but in 1854 it became a territorial possession of the United States under terms of the Gadsden Purchase. In the 1850's, Yuma became the major river crossing for the California gold seekers.

Employment and the Economy

Employment in Imperial County is primarily dependent on agriculture. The County, with its year-round growing season, is one of the largest agricultural producers in the United States. County agricultural production value reached one billion dollars in 1990. According to the U.S. Bureau of Economic Analysis, the two employment categories of Farming and Agricultural Services combined for about 31 percent of total County employment in 1990. After agriculture, the three largest employment categories are government, retail trade, and services, together accounting for about 50 percent of total employment. These economic sectors are largely dependent on agricultural activity.

Agriculture also plays an important role in the Yuma County economy, accounting for more than 20 percent of total employment in 1990 according to the U. S. Bureau of Economic Analysis. Government, trade, and services together account for almost 60 percent of total employment and are more pronounced sectors than in Imperial County, especially in and near the city of Yuma. Contributing to the more diversified economy are the presence of extensive military facilities (over 5,000 jobs) and a growing tourist industry to serve an estimated 2.5 million visitors a year. In the area around the city of Yuma, agriculture is now considered a static economic sector, with tourism becoming the driving force that attracts significant external income into the local economy. Table 26 displays data for recent years in both Imperial and Yuma counties on the size of the civilian labor force and the levels of employment these counties have been experiencing. The combined labor force of both counties is greater than 112,000 persons, with more than 88,000 persons employed.

Both counties have traditionally exhibited relatively high unemployment rates on an average annual basis. In 1992, for example, the rate in Imperial County was estimated at 25.5 percent, while the estimate for Yuma County was about 22.8 percent. Both counties, however, have economies characterized by cyclical fluctuations in employment levels. In Imperial County in 1992, for example, the unemployment rate was 18.6 percent in January and February and 31.9 percent in August. The agricultural industry in

TABLE 26

ANNUAL AVERAGE LABOR FORCE AND EMPLOYMENT
IMPERIAL AND YUMA COUNTIES 1986 and 1992

	YUMA 1986	IMPERIAL	YUMA 1992	IMPERIAL
Civilian Labor Force	45,100	41,150	61,775	56,064
Employment	36,550	31,200	47,950	41,795
Unemployment	8,550	9,950	13,825	14,269
Unemployment Rate	19.0%	24.0%	22.8%	25.5%

Source: California Employment Development Department; Arizona Department of Economic Security

Imperial County, tied to the growing season for local fruits and vegetables, historically has been the driving force behind the cycles in employment and unemployment.Agricultural employment in 1990 varied from an August low of 8,250 workers to a February high of 18,000 and averaged 14,675 for the year.

The cyclical nature of agriculture also strongly influences the economic and employment picture in Yuma County, but this county is moving more rapidly than Imperial County through a transition to a tourist-related economy that is also gradually expanding in manufacturing and warehousing. Because the tourist industry is also highly cyclical due to the area's climate, and because the annual peak in tourism corresponds with the peak in agricultural activity, Yuma County continues to experience seasonal employment fluctuations. In 1992, for example, the unemployment rate was 13.9 percent in January and 31.7 percent in August.

Mining is the smallest industrial sector in both counties, but since 1980 it has been a growing activity in Imperial County. The employment level in mining in Imperial County in 1990 was estimated to be over 730 direct jobs, up sevenfold from pre-1980 levels. Production of geothermal energy, gypsum and precious metals are principal growth activities, with the county's large geothermal reserves representing considerable future potential.

Population

Imperial County had a population of about 109,000 in 1990, as estimated by the U.S. Bureau of the Census. This is an increase of 1.2 percent from 1987 and an increase of about 18 percent since the U. S. Census of 1980. The population growth of the county in this decade is among the most rapid in the state.

Table 27 shows population changes in the county and its seven incorporated cities. El Centro, the county seat, is the most populous city (about 31,400 persons in 1990) and lies about 52 road miles from the project site. The three largest cities (El Centro, Brawley, and Calexico) combined have more than 60 percent of the county's population.

There is no population on the project site. Gold Rock Ranch, approximately 3 air miles from the site,

has between 20 to 25 permanent residents and anywhere from 12 to 150 temporary inhabitants at its peak (winter) season. The closest community of any size to the site is the community of Winterhaven, some 18 road miles to the east on Interstate 8. Winterhaven is on the Imperial County side of the Colorado River but is a suburb of Yuma, Arizona. The year-round population of Winterhaven is estimated to be about 1300.

The 1990 year-round population of Yuma County was estimated by the U. S. Bureau of the Census to be about 107,000 persons, a 19.5 percent increase from 1987. Table 27 shows Yuma County growth since 1985. Arizona conducted a special (1985) census after the 1983 split of old Yuma County into La Paz and Yuma counties. La Paz County lies north of Yuma County, too distant from the project site to be affected by project operations. Also shown in Table 27 is population information since 1980 for the City of Yuma, the county seat and the center of population and regional economic activity.

The city is about 23 road miles from the project site. Like the county, the city and nearby unincorporated areas have been growing rapidly, especially the western Yuma Valley and the foothill area to the east. When combined, the city and these environs have more than 80 percent of Yuma County's population.

Both Imperial and Yuma counties, especially in and around their principal cities, are projected by state agencies to continue their growth into the foreseeable future. Projections of Imperial County anticipate a population of over 142,000 by the year 2000, a 30 percent increase over the 1990 level. Yuma County

TABLE 27

YEAR-ROUND POPULATION, IMPERIAL AND YUMA COUNTIES
1980-1990

	1980[1]	1986[2]	1987[3]	1990[4]
Imperial County	92,110	105,800	107,700	109,303
Brawley	14,753	17,750	18,250	18,923
Calexico	14,545	17,750	18,500	18,633
Calipatria	2,596	2,710	2,670	2,690
El Centro	24,015	27,700	28,400	31,384
Holtville	4,355	4,770	4,900	4,820
Imperial	3,440	3,950	4,120	4,113
Westmorland	1,572	1,830	1,830	1,380
Yuma County	N/A	85,672	89,500	106,895
City of Yuma	43,057	46,807	54,362	54,923

Source:
[1]Bureau of the Census, 1980.
[2]For Imperial County, source is California Department of Finance, Population Research Unit; for Yuma County, source is Special Census of 1985.
[3]For Imperial County, see Note 2 above; for Yuma County, source is Population Technical Advisory Committee of the Arizona Department of Economic Security; for the City of Yuma, source is the City Planning and Zoning Department based on a 1980 census criteria, annexations and housing units.
[4]Bureau of the Census, 1990

is projected to reach 135,000 by 2000, a 26 percent increase. Almost all of this growth is expected in Yuma and the surrounding suburbs.

Housing

There is no residential occupancy on the American Girl Project site. Project security personnel have 24-hour access to the site, but do not reside on or adjacent to the site.

According to 1990 U. S. Census data, housing in Imperial County consists of over 36,500 units, about 60 percent single-family (one-unit) dwellings and about 40 percent mobile home and multi-family units. Most of the multi-family units are located in the larger, incorporated communities. On a countywide basis, about 80 percent of the housing is permanent and about 20 percent consists of mobile homes. Most of the permanent housing is in the larger communities, with most of the mobile homes in the unincorporated areas. Since 1980, the housing stock is estimated to have increased by about 13 percent. The vacancy rates are lower in the County's incorporated cities, and average about 10 percent in the County. The vacancy rate is about 5.4 percent in El Centro.

The housing stock in Yuma County was estimated to be over 46,500 units in 1990. Housing in the city of Yuma and its environs is within easy commuting distance of the project site. Most current employees of the American Girl Project live in the Yuma area. Because of the large seasonal visitor population, a high proportion of the housing stock in the Yuma area is in mobile home and recreation vehicle parks. There are an estimated 18,000 mobile home/recreational vehicle rental spaces in the Yuma area. Demand for spaces is high, but supply is also increasing. The Yuma area has an estimated total of 8,000 rental units. Most rents range from $300 to $750 a month.

Although variable because of seasonal fluctuations, the average annual housing vacancy rate in the city of Yuma was approximately 15 percent according to the 1990 Census data. Housing availability is much tighter in the peak season (winter) months. There is an ample supply of vacant land to accommodate future new housing starts.

Public Services and Utilities

Most public services related to the proposed project are provided by either Imperial County or local municipal governments. To the extent that employees of the project live in Yuma, the closest major municipal services are provided by either Yuma County or the city of Yuma.

The American Girl Project is operating in a sparsely inhabited area of Imperial County where the local population base is insufficient for maintaining separate service facilities. Therefore most facilities, such as police and fire stations, schools, libraries, and hospitals, are located in the more populous areas. The closest major communities are large enough and urban enough to maintain a full range of public services.

Most agricultural and potable water for use in Imperial County is obtained from the Colorado River via the All-American Canal and conveyed by the Imperial Irrigation District (IID). Yuma County draws much of its water from the river as well. In

sparsely populated, outlying rural areas, including the region around the project site, water for domestic use is provided by individual groundwater wells. One such well is the primary source of water at Gold Rock Ranch. The water from area wells is generally not potable, however, so bottled water is used for drinking.

There are public sewer services in all the larger communities, provided by municipal governments or special districts. In less densely populated areas, individual sewage disposal systems are more common. Scattered dwellings and ranches in the county's very rural areas rely on individual sewage disposal methods.

Electric power is provided to Imperial County by IID and to Yuma County by Arizona Public Service Co. There are no natural gas lines in the vicinity of the project site. Bottled gas is available from local distributors.

Fiscal Conditions

As the American Girl Project is located in Imperial County, revenues accrue to that county from American Girl operations in the form of taxes, licenses, and fees. Over the life of the project, property tax payments will be the single most important contribution from the American Girl Project to county revenues. Property taxes are an important component of overall County revenues. In fiscal year 1991-92, the county budget included about $17.1 million in property tax revenue. Countywide assessed valuation (upon which property taxes are based) has steadily increased over the last decade. Property taxes are the second largest source of County revenue, behind the State and Federal Aid category. The County budget indicates that public assistance (41 percent of the total), public protection (25 percent), and general government (16 percent) were the major County expenditures in 1991-92.

Because there are no project-related facilities within Yuma County, that County does not receive any direct property tax revenues. However, because the vast majority of American Girl Project employees live in Yuma County, the County receives indirect revenue from property taxes and sales taxes paid by these employees.

Current Relationship of the American Girl Project with the Socioeconomic Environment

As of October, 1993, the two operating components of the American Girl Project employ 157 persons. 141 persons were employed as operating personnel, with the remaining 16 persons serving in administrative roles. Peak employment at the project was reached in 1991, when 164 persons were employed. The 1992 payroll was over $5.186 million, with an average annual salary of $31,626 per worker. Over 90 percent of current employees live in the city of Yuma, Arizona or its suburbs. Only six percent of employees live in Imperial County in the El Centro/Brawley/Calexico/Holtville area. Based on the 1992 assessed valuation of the two operating components of over $28 million, the American Girl Project will pay over $290,000 in 1993 property taxes to Imperial County.

CHAPTER 4

CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

An analysis of the potential environmental and socioeconomic consequences that would result from implementation of AGMJV's proposed action or the alternatives is provided in this chapter of the EIS. For the purposes of this EIS, environmental impact is defined as a modification in the status of the environment as it presently exists or as it is anticipated to be in the future as a result of the proposed action or alternatives. Environmental impacts can be positive (beneficial) or negative (adverse), as a result of the action (direct) or as a secondary result (indirect), and can be long-term (greater than 10 years) or short-term (less than 10 years) in duration. Impacts can vary in degree or magnitude from no change, or a change which does not constitute a substantially adverse impact on the environment and related resources (not significant), to an identifiable major adverse change in the environment (significant). Because of their importance in understanding the cause and scope of impacts, the terms "direct", "indirect", "cumulative", and "significant" are further discussed below.

Impacts to an environmental resource which are solely attributable to an action are termed "direct". They are caused by, and occur at the same time and place as, a specific action. For instance, emissions have a direct impact on air quality at the time and place the emission occurs. "Indirect" effects are reasonably foreseeable and may be attributable to a particular action, but they occur later in time or farther removed in distance from the action than a direct effect. For instance, new roads for a mine development could directly affect recreational opportunity by causing an identifiable change in access to the recreational resource. An indirect impact of the new roads could be an increase in recreationalists.

As used in NEPA, "significant" impacts are defined by their context and intensity. Generally, impacts are identified in the context of the project area, and the extent these impacts are perceptible beyond the project area. Intensity relates to the degree of the effect on public health, safety, and unique characteristics of the area, and the degree of controversy or risk. Impacts may be insignificant individually but significant when added together. An impact which violates a law imposed for the protection of the environment is generally significant.

An evaluation of environmental impacts must assess both the types and magnitude of the identified impacts for each environmental resource present in the proposed operational area (i.e., existing environment as described in Chapter 3 of this EIS). In general, the criteria for evaluating each environmental discipline are similar. Criteria for determining the types of impacts which may occur include the following:

- *resource sensitivity, or the probable response of a particular resource to the proposed action;*

- *resource quality, or the present condition of the resource potentially affected;*

- *resource quantity, or the amount of the resource potentially affected; and*

- *duration of impact, or the period of time over which the resources would be affected.*

In addition to these criteria, evaluation criteria for assessment of potential impacts have been established for some of the environmental resource areas as a result of standards in regulations or guidelines such as the Endangered Species Act (wildlife), Migratory Bird Treaty Act (wildlife), Clean Air Act (air quality), and the National Historic Preservation Act (cultural resources).

Quantitative levels of impacts for assessment of impact magnitudes include:

- *high adverse impact -- a high impact would result if proposed activities would potentially cause a substantial adverse change or stress to an environmental resource or resources;*

- *moderate adverse impact -- a moderate impact would result if proposed activities would potentially cause some identifiable adverse change or stress to an environmental resource or resources;*

- *low adverse impact -- a low impact would result if proposed activities would potentially cause an insubstantial or small adverse change or stress to an environmental resource or resources;*

- *no identifiable impact -- no identifiable impact (either positive or negative) would indicate that no measurable impact would occur to the specific resource (s) under investigation; and*

- *beneficial impact -- a beneficial impact would result in an actual improvement to the specific resource (s) under investigation as a result of proposed activities. A beneficial impact would be ranked low, moderate, or high, depending upon the magnitude of the improvement that is projected.*

Anticipated impacts for five alternatives in addition to the proposed action are addressed in this analysis. The five alternatives considered in this EIS include (see Chapter 2 for a complete discussion of each alternative):

- *Alternative 1 -- No action.*
- *Alternative 2 -- Complete backfilling of Oro Cruz waste rock.*
- *Alternative 3 -- Cyanide Solution via drip emitters.*
- *Alternative 4 -- Floating cover on ponds containing cyanide solution.*
- *BLM'S Preferred Alternative -- A combination of the proposed action and Alternative 3.*

The General Mining Law of 1872 grants a statutory right to explore, develop, and produce certain minerals on public lands open to mineral entry. It is BLM's responsibility to ensure that the development of the action does not violate federal and laws, such as those pertaining to air and water quality, endangered species, migratory birds, and cultural resources. In addition, BLM must ensure that the

proposed action does not cause "unnecessary or undue degradation" of public lands to comply with regulations of 43 CFR Part 3809. If legal limitations cannot be met or if the proposed action results in "undue or unnecessary degradation," the proposed operation would have to be redesigned, postponed, or dropped from further consideration. until these legal and/or regulatory requirements could be met.

THE ORO CRUZ OPERATION AS PROPOSED BY AGMJV

Climate & Air Quality

This section quantifies the environmental impacts on air resources posed by air pollutant emissions from the proposed Oro Cruz operation mining operations. Once air emissions and off-site impacts are quantified, impacts are compared to three significance criteria. These criteria are defined as follows:

- *impacts that result in a violation of any federal or state ambient air quality standard,*
- *in areas that have been designated non-attainment for any pollutant, impacts that delay any area's progress towards attainment of the state or federal ambient air quality standard for such pollutant, and,*
- *impacts that result in substantial degradation of visual range in the surrounding area.*

Thus, if air regulations are met, the impacts are considered insignificant.

Given current mining and processing plans, the emissions (and associated off-site impacts) of principal concern are process dust (e.g., dust from the crusher and leaching systems) and non-process dust (e.g., dust from materials handling, blasting, and ore and waste hauling along unpaved haul roads). Emissions and off-site impacts of NO_x, SO_2, CO, and VOCs from the combustion of fossil fuels are also quantified.

California's AB 2588 Air Toxics "Hot Spots" Program requires the quantification of emissions of all California-listed hazardous air pollutants (HAPs) and estimation of risk posed by HAPs emissions from existing facilities. AGMJV is currently involved with the AB 2588 risk assessment process for its existing American Girl Canyon operation. A HAPs emissions inventory was submitted in November of 1992 to the APCD for review. The APCD categorized the facility as low priority for the purpose of risk assessment due to the "potency, toxicity, quantity and volume" of hazardous materials released by the current project, as well as the proximity of the facility to potential receptors. Being a low priority facility, AGMJV is not required to prepare a risk assessment under AB 2588. AGMJV is required to prepare and submit a biennial update of the emissions inventory plan and report. The first update is due in November of 1994.

Due to the similarity of activity rates, emission sources, and emission rates between the American Girl Canyon and Oro Cruz, it is anticipated that the HAPs emission inventory for American Girl Canyon contains emission estimates that would be representative of emissions from the proposed Oro Cruz operation. Future biennial updates to the HAPs

emission inventory would include estimates of HAPs from Oro Cruz operations.

A maximum emissions case analysis of on-site impacts of hydrogen cyanide (a substance known by the State of California to cause non-cancer health effects) is presented as an indicator of the potential for significant risk posed by HAPs emissions from the Oro Cruz operation. Due to the sparsely populated area around the AGMJV operations and APCD's low priority categorization of American Girl Canyon, it is anticipated that a study of health risks posed by American Girl Canyon (or Oro Cruz) would not result in a finding of significant risk. ("Significant" levels of risks are to be determined by the APCD in the course of its review of risk assessments submitted by various sources within the county.)

Description and Quantification of Emissions. Emissions from the proposed action would occur from a variety of sources. The quantities of emissions (as mitigated by control technologies and measures) are estimated below.

Sources and Emissions. Activities at the proposed Oro Cruz mining operations would generate emissions of process and non-process dust, products of combustion and volatilization of fossil fuels (PM_{10}, SO_2, NO_x, CO, and VOCs), and a small amount of HCN emissions. Non process particulate emissions would be caused by the physical processes of loosening and hauling ore and waste, and material handling. Particulates would be emitted due to the crushing of ore. Combustion emissions would be caused by burning diesel fuel and gasoline in mobile mining equipment. HCN, an air toxic, would be emitted due to evaporative loss of sodium cyanide (NaCN) solution from the leaching and milling operations. Although process and non-process dust would likely contain small amounts of California-listed air toxics (e.g., heavy metals contained in soils), there are no nearby residents to be exposed. It is anticipated that HCN emissions would be the most significant of the HAPs from Oro Cruz operations. A maximum emissions case assessment of health effects posed by the project's HCN emission is likely to provide an upper-bound of health risks due to emissions of HAPs.

A listing of all Oro Cruz emission sources and their associated pollutants is presented in Table 28. The table is divided into ore processing and ore and waste material handling operations and specifies the sources associated with each operation (i.e., crushing, milling, etc.).

Emissions Inventory. The tools and assumptions used to estimate emissions from the proposed operation are conservative, representing a theoretical maximum emissions case for the proposed operation. Emissions are estimated based on projected maximum ore processing and mining rates, as provided by AGMJV.

Emissions from any sources currently in use at the American Girl Canyon operation that would remain in use and at their current location during Oro Cruz operations are estimated using the incremental increase between proposed Oro Cruz and current American Girl Canyon activity rates. Emissions from any sources relocated to the Oro Cruz operation, or new to the Oro Cruz operation, are estimated using total activity rates.

TABLE 28

ORO CRUZ SOURCES AND EMISSIONS

SOURCE	POLLUTANTS
ORE PROCESSING	
Crusher	
Crushing (primary, secondary)	PM_{10}
Load/unload lime	PM_{10}
Load/unload ore	PM_{10}
Load/unload aggregate	
Ore storage piles	PM_{10}
Mill	
Load/unload ore	PM_{10}
Load/unload tailings	PM_{10}
Mill	HCN
Leach Pad	
Load/unload ore	PM_{10}
Pad	HCN
Unpaved road travel	PM_{10}
Diesel/gas vehicles	PM_{10}, SO_2, NO_x, CO, VOCs
Agglomerator	
Load/unload cement	PM_{10}
Material transfers	PM_{10}
ORE AND WASTE MATERIAL HANDLING	
Pit	
Drilling, blasting	PM_{10}
Load ore/waste to truck	PM_{10}
Unpaved road travel	PM_{10}
Diesel/gas vehicles	PM_{10}, SO_2, NO_x, CO, VOCs
Pit erosion	PM_{10}
Explosives	SO_2, NO_x, CO
Portal	
Batch plant material handling	PM_{10}
Diesel/gas vehicles	PM_{10}, SO_2, NO_x, CO, VOCs
Fuel loading/storage	VOCs
Explosives	SO_2, NO_x, CO
Waste Rock Dump	
Unload waste to storage	PM_{10}
Unpaved road travel	PM_{10}
Diesel/gas vehicles	PM_{10}, SO_2, NO_x, CO, VOCs
Waste dump erosion	PM_{10}
Aggregate Borrow Pit	
Load aggregate	PM_{10}
Diesel/Gas Vehicles	PM_{10}, SO_2, NO_x, CO, VOCs
Borrow pit erosion	PM_{10}
Haul Roads	
Unpaved road travel	PM_{10}
Diesel/gas vehicles	PM_{10}, SO_2, NO_x, CO, VOCs

Source: Air Sciences Inc., 1993.

Emissions from any sources currently in use at the American Girl Canyon site that would remain in use and at their current location but would not have increased emissions due to Oro Cruz operations (e.g., generators) are not included in the emissions inventory for the proposed action. Total emissions from all of these existing sources that would remain at American Girl Canyon, as well as all new and relocated emission sources associated with the Oro Cruz operations, are quantified and modeled for off-site impacts in the Cumulative Impacts section of this EIS.

Oro Cruz mining operations would consist of concurrent surface and underground mining. Ore would be hauled to the American Girl Canyon site, where processing by heap leaching or milling would continue at the existing facilities. Waste rock would be hauled to the waste dumps located on the Oro Cruz site. The American Girl concrete batch plant would be relocated to near the underground portal at the Oro Cruz site to produce concrete for backfilling of underground stopes. Aggregate used for backfill would be supplied from the borrow pit west of the Padre Madre leach pad and hauled to the crusher at the American Girl site. Aggregate would then be hauled to the concrete batch plant at the Oro Cruz portal on a return trip from ore hauling to the crusher. Daily and annual activity rates for all mining and processing operations have been estimated and are summarized in Table 29.

Milling activity rates of the proposed Oro Cruz operation would be approximately 14 percent greater than current American Girl Canyon milling activity rates. Crushing and leaching activity rates would decrease for the proposed Oro Cruz operations as compared to current American Girl activity rates.

Because hauling distance between the proposed Oro Cruz pits and the crusher is significantly greater than the hauling distance from the American Girl Canyon pit(s) to the crusher, maximum emissions are estimated when all mining is assumed to occur at the Oro Cruz pit(s) (as opposed to a split of activities between the proposed Oro Cruz and existing American Girl operations). All surface mining is assumed to occur at the proposed Queen Pit due to its

TABLE 29

ORO CRUZ ACTIVITY RATES

Operation	Activity Rate (tons/day)	Activity Rate (tons/year)
Surface ore	5,500	1,000,000
Underground ore	1,000	250,000
Waste	22,500	4,040,000
Aggregate	2,885	150,000
Crushing	10,000	1,400,000
Milling	750	270,000
Leaching	9,250	1,130,000

Source: Air Sciences Inc., 1993.

proximity to the site boundary (i.e., activity at this pit is more likely to cause off-site impacts).

A spreadsheet program was used to calculate emission estimates for the emissions inventory. Emission factors have been taken directly from (or calculated based on equations contained in) the Environmental Protection Agency's AP-42 (4th ed.). In general, AP-42 emission factors for surface-level non-process dust sources from mining projects are considered to be conservative and represent maximum emission estimates.

Emission Controls. Particulate emissions from several sources at the proposed Oro Cruz operation would be controlled by implementing air pollution control measures currently used at the American Girl Canyon operation. These controls are presented in Table 30 along with the estimated control efficiency of each measure. Control efficiencies are based on control equipment manufacturer information and/or previous mining experience. Emissions from sources that are controlled are estimated and modeled at the reduced emission rates.

Emissions Quantification. Tables 31 and 32 summarize the daily and annual emissions from the Oro Cruz operation, respectively. PM_{10} and NO_x are the pollutants that would be emitted in the largest quantities. The majority of PM_{10} emissions originate from non-process particulate sources. The majority of NO_x emissions originate from mobile sources, with a small quantity emitted from explosives use. NO_x emissions from the diesel generators are only included in the Cumulative Impacts section of this EIS because the generators would continue to operate at current levels at the American Girl Canyon location.

Dispersion Models. Long- and short-term impacts for receptors at or below the height of the mine sources are modeled using the Industrial Source Complex-Short Term (ISCST2) model, version 92273. This model is recommended by the EPA for site-specific analyses of complicated sources, and is appropriate for sites with fugitive emissions and rolling terrain. Long-term modeling is performed with ISCST2 using the "period" average option for the period of available meteorological data.

TABLE 30

CONTROL TECHNOLOGY AND EFFICIENCY

Source	Control	Efficiency
Crushers	Water sprays	90%
Lime silo	Baghouse	90%
Haul roads	Water sprays/chemicals	92%
Drilling	Water sprays/dust shroud	80%
Cement silo	Baghouse	90%

Source: Air Sciences Inc., 1993.

TABLE 31

SUMMARY OF DAILY MAXIMUM EMISSIONS
DUE TO ORO CRUZ OPERATIONS
(units in pounds per day)

Source	PM_{10}	SO_2	NO_x	CO	VOCs	HCN*
Process	57	---	---	---	---	68**
Non-Process	1,502	---	---	---	---	
Mobile	88	69	1,368	555	89	---
Explosives/ Fuel storage	---	24	204	804	negl.	---
Total (lbs)	1,647	93	1,572	1,359	89	68
(tons)	0.8	0.05	0.8	0.7	0.04	0.03

* HCN emissions calculated by Environmental Solutions (1992).
** Daily emissions are annual data divided by 365 days per year.

Source: Air Sciences Inc., 1993.

TABLE 32

SUMMARY OF ANNUAL MAXIMUM EMISSIONS
DUE TO ORO CRUZ OPERATIONS
(units in tons per year)

Source	PM_{10}	SO_2	NO_x	CO	VOCs	HCN*
Process	7	---	---	---	---	12
Non/Process	137	---	---	---	---	---
Mobile	9	7	141	58	9	---
Explosives/ Fuel storage	---	1	7	27	negl.**	---
Total	153	8	148	84	9	12

* Environmental Solutions, Inc. 1992.
** VOC emissions from fuel storage are calculated to be 49 lbs/year.

Source: Air Sciences, Inc., 1993.

Complex-I (version 92290) air dispersion model is recommended by EPA for determining long- and short-term impacts of receptors at elevations above the nearest emission source. Dispersion modeling of Oro Cruz operations and cumulative operations are performed using one full year of on-site data collected at the Padre Madre monitoring station from December 1991 through November 1992. The selected year's data are consistent with and representative of the longer-term meteorologic trends on site.

Quantification of Impacts. Estimated maximum impacts for PM_{10}, SO_2, NO_x, and CO are presented in Table 33. This table also includes baseline concentrations, the location of the receptor with the highest impact, and listings of federal and California state standards for comparison. Emissions of VOCs have not been modeled due to the relatively low emission rate (6 percent of the NO_x emission rate), the absence of applicable air quality standards, and the low background levels expected in the project area. Maximum impacts contained in Table 33 reflect an elevation/standard atmosphere adjustment of 1.03. Model output concentrations for the maximum receptors have been multiplied by this factor due to the site elevation of 700 feet ASL.

TABLE 33

MAXIMUM ESTIMATED AIR QUALITY IMPACTS DUE TO THE ORO CRUZ OPERATION

Pollutant	Averaging Increment	Maximum impact $\mu g/m^3$	Baseline $\mu g/m^3$	Total conc. $\mu g/m^3$	Location (relative to Queen Pit)	NAAQS $\mu g/m^3$	California Ambient Standard $\mu g/m^3$
PM_{10}	24-hour	37.7	26.0$^+$	63.7	WSW of pit	150	50
	Annual	3.1	18.9*	22.0	S of pit	---	30*
	Annual	3.1	26.0$^+$	29.1	S of pit	50	---
SO_2	1-hour	31.0	NA	31.0	W of pit	---	655
	3-hour	16.9	NA	16.9	WNW of pit	1,300	---
	24-hour	2.8	NA	2.8	NW of pit	365	105
	Annual	0.3	NA	0.3	ESE of pit	80	---
NO_x	1-hour	461.0	NA	461.0	W of pit	100	470
	Annual	4.5	NA	4.5	ESE of pit	---	---
CO	1-hour	636.0	NA	636.0	W of pit	40,000	23,000
	8-hour	158.0	NA	158.0	WSW of pit	10,000	10,000

\+ = 5-year arithmetic mean of complete data years at Gold Rock Ranch PM_{10} monitoring station
* = Geometric mean
NA = data not available

Source: Air Sciences Inc., 1993.

PM$_{10}$. The maximum 24-hour impact at the nearest public access location is 37.7 $\mu g/m^3$ west-southwest of the proposed Oro Cruz operation. This value is added to the average baseline particulate concentration (26.0 $\mu g/m^3$) for comparison with the national and California 24-hour standards. The resulting maximum 24-hour PM_{10} concentration is 63.7 $\mu g/m^3$.

The highest annual PM_{10} impact is estimated to be 3.1 $\mu g/m^3$ at a location south of the proposed Oro Cruz operation and northwest of the American Girl Canyon facilities. Impact concentrations are calculated as annual arithmetic means. This concentration, when added to the estimated arithmetic mean baseline concentration for PM_{10}(26.0 $\mu g/m^3$) results in an annual average concentration of 29.1 $\mu g/m^3$ and is directly comparable to the federal annual PM_{10} standard of 50 $\mu g/m^3$ (also an arithmetic mean).

The California annual PM_{10} standard, on the other hand, is in the form of a geometric mean. Using the data from the PM_{10} monitoring station at the Gold Rock Ranch, a geometric mean baseline concentration has been calculated. The dispersion model's estimated impacts, however, could not be directly converted from arithmetic to geometric mean. Given the nature of the available data, it is appropriate to add the modeled impacts (arithmetic mean) to the geometric mean baseline (18.9 $\mu g/m^3$) for a total of 22.0 $\mu g/m^3$, to be compared with the California annual PM_{10} standard. This is a conservative approach, as the geometric mean of the modeled impacts would be lower than the arithmetic mean.

SO$_2$. SO_2 has been modeled using a 1-hour, 3-hour, 24-hour and an annual average. The maximum 1-hour SO_2 impact is predicted to be 31.0 $\mu g/m^3$ west of the proposed Queen pit. The maximum 3-hour SO_2 impact is predicted as 16.9 $\mu g/m^3$ west-northwest of the pit. The maximum 24-hour SO_2 impact is predicted as 2.8 $\mu g/m^3$ northwest of the pit and the highest annual average impact on the study boundary is 0.3 $\mu g/m^3$ east-southeast of the pit.

SO_2 is not currently monitored by the APCD or by AGMJV. In addition, baseline levels of SO_2 have not been collected by the APCD and are not available at the time of this writing. Since the project is located in a rural setting, remote from major industrial sources and cities, baseline SO_2 concentrations are assumed to be negligible. As a result, maximum SO_2 impacts are directly compared to all SO_2 standards.

NO$_x$. NO_x has been modeled using a 1-hour and an annual average. The maximum 1-hour NO_x impact is predicted as 461 $\mu g/m^3$ west of the Queen pit. The highest annual average impact on the study boundary would be 4.5 $\mu g/m^3$ east-southeast of the pit. NO_x baseline information is also not available and projected impacts are directly compared to the standards.

CO. CO has been modeled using a 1-hour and an 8-hour average. The maximum 1-hour CO impact is estimated as 636 $\mu g/m^3$ west of the Queen pit. The highest 8-hour average impact on the study boundary would be 158 $\mu g/m^3$ to the west-southwest of the pit. CO baseline data is also not available. Impacts are directly compared to the standards.

HCN. During the leaching process, a small amount of HCN in equilibrium with NaCN in solution is released to the air. The amount of HCN released is dependent upon many variables including solution pH, atmospheric conditions, and solution application rate and manner by which it is applied.

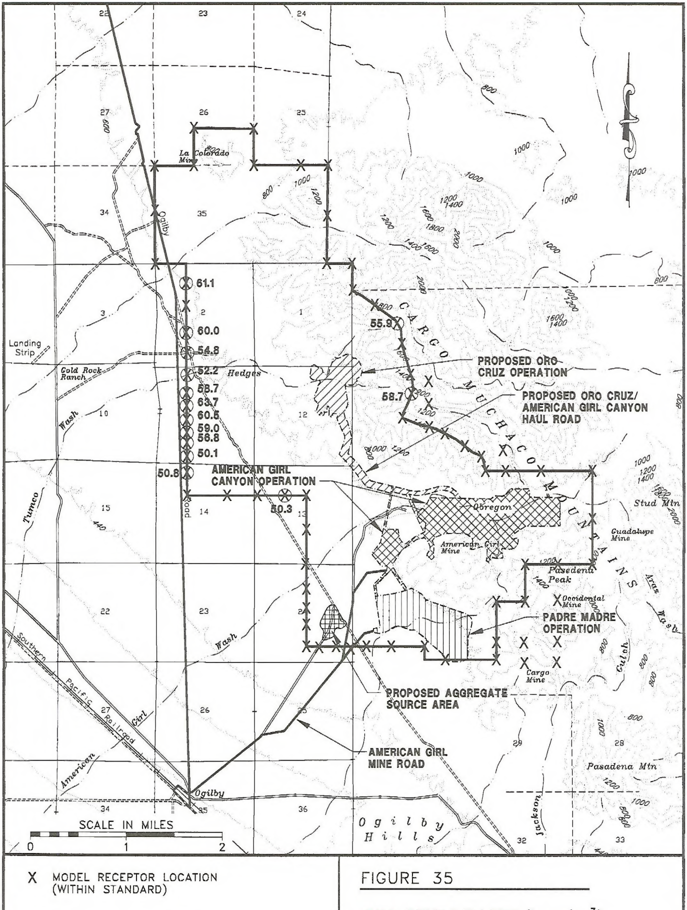
AGMJV's consultant has conducted on-site HCN monitoring at the American Girl Canyon leach pad. Using this data, as well as local meteorological data, calculations were made to determine HCN emissions. Their work estimates annual emissions of 12.4 tons per year for current operations. Assuming a similar leaching solution application rate throughout the life of the Oro Cruz operation, emissions should remain at this rate.

These emissions were modeled using a 1-hour averaging period and impacts immediately surrounding the leach pad (at a distance of 100 meters) were estimated. All receptors for this study were located within the American Girl Mine boundary. Modeling results indicate that maximum impacts are 44.6 $\mu g/m^3$ west of the leach pad.

Significance of Impacts. As stated previously, the significance of operational impacts are judged by whether or not the project would meet federal, state, and APCD ambient air quality standards. (See Table 15 presented previously.) It should be noted that the federal Prevention of Significant Deterioration (PSD) incremental standards are not used as a significance criteria because the proposed Oro Cruz operation and existing American Girl Canyon operations do not meet the definition of major source under the PSD regulations (i.e., 250 tons per year of any criteria pollutant from process sources), and are therefore not subject to PSD increment standards.

Particulate Emissions. The PM_{10} maximum 24-hour impact (37.7 $\mu g/m^3$) plus the average monitored baseline concentration (26.0 $\mu g/m^3$) is within the NAAQS for PM_{10} but exceeds the California standard of 50 $\mu g/m^3$. Figure 35 shows the receptors modeled to exceed this standard. Exceedances of the California 24-hour standard are common in the desert basins of California as shown by the measurements at Gold Rock Ranch (assumed to be a background or baseline station). Occasional exceedances of the California 24-hour standard are expected for nearly all surface mining operations in arid areas throughout California. A review of PM_{10} and meteorologic data serves to explain why the impact analysis for the Oro Cruz operation shows occasional exceedances of the California standard and indicates that the impact analysis likely overpredicts total 24-hour ambient levels of PM_{10}.

Historic PM_{10} monitoring data collected at the Padre Madre operation reveal that on days when exceedances of the California 24-hour standard occur, the "background" monitoring station and "impact" monitoring station record virtually identical ambient PM_{10} concentrations (i.e., PM_{10} impacts from natural disturbance of soils overwhelm PM_{10} impacts from anthropogenic sources such as mining operations). These occasional high background levels of PM_{10} serve to increase the arithmetic average 24-hour background PM_{10} concentration, and usually occur on days with high winds that entrain soils into the ambient air.



X MODEL RECEPTOR LOCATION (WITHIN STANDARD)

⊗ RECEPTORS WITH EXPECTED EXCEEDANCE OF STANDARD

FIGURE 35

ORO CRUZ IMPACTS (in ug/m^3)
PM_{10} 24-HOUR CALIFORNIA STANDARD
(50 ug/m^3)

Conversely, dispersion modeling indicates that maximum off-site impacts from mining operations typically occur during short-term periods of sustained low velocity winds in a consistent direction. These conditions are favorable for causing the model to disperse surface-level emissions in one direction, and result in the estimation of maximum off-site PM_{10} impacts. These conditions, however, are not conducive to producing high background levels of PM_{10}. Therefore, strict addition of estimated impacts and the average background concentration would likely over-estimate ambient levels.

On a long-term basis, predicted annual average concentrations, when added to annual average background concentrations, are not expected to exceed the federal or state annual standards. Therefore, impacts would not be significant.

Gaseous Emissions. Estimated SO_2, NO_x, and CO impacts, when compared directly to federal and state standards for all averaging periods, are not expected to exceed standards. Therefore, impacts would not be significant.

Toxic Emissions. A comparison of HCN impacts to the state's acute acceptable exposure level (AEL), listed in the California Air Pollution Control Officers Association Risk Assessment Guidelines, indicates on-site impacts are below this level (3,300 $\mu g/m^3$) by a factor of nearly 100. As a result, it can be concluded that impacts off site would be lower and neither the acute, nor the chronic (70 $\mu g/m^3$) AEL are likely to be exceeded. As stated above, American Girl Canyon has been categorized as a low priority facility based on the APCD's review of the AB 2588 HAPs emission inventory for the facility. As a result, no comprehensive health risk analysis is required and risk estimates pertaining to other HAPs are not available. It is anticipated that the insignificance of HCN impacts is an indicator that the impacts of other HAPs emitted from the Oro Cruz operation would not be significant.

Non-Attainment Status. Imperial County is designated non-attainment for PM_{10} and ozone. As discussed in Chapter 3, comparison of the "impact" monitoring station PM_{10} levels and the "background" monitoring station PM_{10} levels indicates that natural or background dust is the most significant contributor of monitored PM_{10} levels on high PM_{10} days (days during which the PM_{10} standards would be violated). The monitoring data suggest that current project emissions do not significantly contribute to PM_{10} levels on days during which the PM_{10} standard is violated. In addition, the proposed operation would not result in an increase in currently permitted PM_{10} emissions (Imperial County Permit No. 2029A). Therefore, there is no expected increase in off-site PM_{10} impacts from the proposed operations.

The modeling performed for this EIS indicates that exceedances of the federal standards are not expected. Therefore, off-site impacts due to PM_{10} emissions from the proposed action are not expected to impede the county's progress in attaining the federal PM_{10} standards. (A discussion of modeled exceedances of the California 24-hour PM_{10} standard is included in a previous section).

The most likely reason for exceedance of the ozone standard is long range transport of ozone and its precursors (NO_x and VOCs) from automobile emissions in the South Coast Air Quality Basin (the

greater Los Angeles area and Mexico). Given the relatively small volumes of NO_x and VOC emissions estimated for Oro Cruz sources, it is unlikely that emissions from the proposed operation would significantly contribute to ozone formation at Imperial County's ozone monitoring sites or that these emissions would impede the progress of the county in attaining the ozone standards.

Visual Standards. The Oro Cruz operation would be very similar to current American Girl Canyon/Padre Madre activities, with the exceptions that the location of some sources would be moved and milling activity rates would increase slightly (10-15 percent), while crushing and leaching activities would decrease. Because there is currently no substantial degradation to the visual range in the surrounding area, visual quality is not expected to deteriorate as a result of the Oro Cruz operation, and impacts would therefore not be significant.

Impact Mitigation. AGMJV has proposed environmental protection measures (see Chapter 2) to reduce potential adverse effects. No additional mitigation measures would be required to reduce impacts to air quality.

Residual Effects. Short-term increases in air emissions would result from the proposed operation. Emissions would be within regulatory limits. Impacts would not be significant.

Geology and Geotechnical Issues

Topography and Geomorphology. If Oro Cruz development is approved, mining and waste rock disposal would alter the topography and geomorphological conditions in Tumco Wash valley. Altered topographic features in Tumco Wash would consist of the Cross open pit, the Oro Cruz waste rock dump, and smaller development waste rock dumps adjacent to the Cross pit. The Queen pit would be backfilled to 20-40 feet above the valley floor after completion of mining.

The only altered topographic features in American Girl Canyon resulting from proposed Oro Cruz operations would be the existing heap leach facility. The magnitude and scope of impacts to the topographic features that would be altered by Oro Cruz operations are summarized in Table 34. No unique geologic or physical features would be destroyed, conveyed or significantly modified. There would be no potential public health hazard from exposure to unstable geologic hazards.

Overall, development of features in the Tumco wash would constitute a low adverse impact to topography and geomorphology. The visual impact of these features is discussed elsewhere in this chapter. Accommodation of Oro Cruz ore and tailings in the American Girl Canyon would not be a significant impact to topography and geomorphology.

Slope Stability of Structures. Post-reclamation stability of proposed Oro Cruz and existing American Girl Canyon structures was evaluated by selecting a two-dimensional cross section through areas of each structure that would be most critical for stability, (WWL 1993). These areas were selected based on height of structure, outside slope, and foundation slope. Slopes for each selected cross section were initially analyzed at their current or planned overall

TABLE 34

ORO CRUZ OPERATIONAL FEATURES AFFECTING TOPOGRAPHY

Structure/Feature	Area of new dis-turbance (acres)	Maximum Height [or Depth] (ft)	Top [or Bottom] Surface	Overall Side Slopes (H:V)	Comment
Cross pit	20	[500]	[benched]	1:1	new feature
Queen pit	10	[240]	[benched]	1:1	new feature
Oro Cruz waste rock dump	43	180	nearly flat	2:1	new feature
Oro Cruz development dumps	13	120	benched to top	1.5:1	new feature
American Girl Canyon heap leach facility	0	120	nearly flat	2:1 to 2.75:1	existing feature
American Girl Canyon main waste rock dump	0	200	benched to top	2:1	existing feature

slopes of 2:1 (horizontal:vertical). The slopes were then altered (lowered) after each analysis until the minimum required factors of safety had been achieved. The criteria for minimum factor of safety was 1.5 for static conditions. The stability analysis results indicate the following:

- *For an overall slope of 2:1, the waste dumps would be stable. Therefore, for waste dumps currently constructed at an overall 2:1 slopes, no regrading or reduction of slopes would be required for long-term slope stability.*

- *The heap on the leach pad would be stable at an overall slope of 2.75:1. The heap material would be stable at an overall slope of 2:1 if it were to be placed on foundation material without the leach pad. The difference is due to the low friction angle of the synthetic liner on the leach pad. If rinsed, spent ore can be placed beyond the edge of the leach pad, slopes of 2:1 would provide acceptable slope stability. In areas where there is not space for placement of rinsed, spent ore beyond the edge of the leach pad (such as along the north side of the heap) the slopes would have to be reduced to provide for adequate slope stability.*

The most efficient method of regrading the heap slopes to 2.75:1 would be by dozing material from the top of the slope to the bottom of the slope. For a 120-foot high heap, the toe of the regraded slope would be approximately 50 feet beyond the original toe of the heap. There is sufficient space for this regrading, including the Phase IV area, except for a small area along the north side of the heap adjacent to

American Girl Canyon Wash. Impacts from these actions would not be significant.

Subsidence. Underground development would be limited to mining beneath the Cross pit. Access for these workings would be gained after surface mining in the Cross pit has begun. Due to the competency of the rock and the depth and limited size and extent of these workings, subsidence at the ground surface from these new underground workings would not be significant.

No surface subsidence has occurred in the underground component of the American Girl Canyon operation. In addition to the operational experience at American Girl, other considerations support the contention that underground mining at Oro Cruz would result in no surface effects.

- *Ground movement would not occur over areas containing backfill since the cement mix replaces the original mined zone on a 1:1 volummetric basis. Ground movement is only possible in areas left open at the end of mining. Areas such as the production decline and development drifts have been treated as "permanent openings" from the standpoint of geomechanical design. This implies that additional levels of roof support above that used in the ore zone would be employed. Although these areas would not be backfilled, the designed support should insure ground movement would not occur in the future.*

- *If local underground movement were to ultimately occur in an underground opening, the natural tendency would be for the failure to create a natural arch which would be supported by buttresses of unmined rock or cemented backfill. When the arch has fully developed, stresses would equilibrate and movement would end.*

- *If underground movement would at some point occur in a highly broken zone, as might occur in or near the ore zone, the arch could migrate upwards. Due to the swell factor of broken rock, however, the opening would eventually fill and movement would end. As a general rule, two tons of broken rock would fill the same volume as three tons of rock in place (a swell factor of 50%). Thus, if an opening is small, the volume of broken rock would be sufficient to fill the developing arch and partially or wholly support the surface. If a 20 foot original opening is assumed, this would imply that movement would occur to maximum height of 40 feet above the opening. At this point the void would be completely filled with the broken rock and the roof would be supported. Since the depth to the ore zone is at least 300 feet below surface, movement underground would not propagate to the surface.*

***Geologic Resources*.** As discussed in Chapter 3, the American Girl Project area has experienced extensive mining activity in the past. Mining associated with the proposed Oro Cruz operation in Tumco Wash would recover approximately 3 million tons of additional gold-bearing ore from the open-pit and underground mining operations. Although this constitutes removal of geologic resources, it is a necessary effect upon the existing geologic environment. According to U.S. mining law and

BLM regulations, AGMJV has the legal right to mine these resources as long as the operation does not result in unnecessary or undue degradation of public lands.

American Girl Canyon Heap Leach Capacity. The maximum height of the American Girl Canyon heap leach would be 120 feet. The permitted area to be disturbed for heap leach phases 1, 2 and 3 is about 31 acres. The Phase 4 disturbance area (for Oro Cruz ore) is about 11 acres. Water, Waste & Land (WWL, 1992b) performed an analysis of the heap leach capacity based on these perimeters. The analysis determined that a maximum of 8 million tons of materials could be placed on the heap leach.

As of mid-1993, the only materials that had been placed on the American Girl Canyon heap leach were heap ores from the American Girl Canyon surface mining operations. Additional materials to be placed on the heap in the future would include more American Girl Canyon heap ores, Oro Cruz heap ores (if Oro Cruz is approved), agglomerated tailings and agglomeration additives. The existing and/or projected tonnages of these materials is shown on Table 35. The projected total of 7.6 million tons, compared to the estimated maximum of 8 million tons, indicates that the American Girl Canyon heap leach has the capacity to handle the projected heap ores from American Girl Canyon and Oro Cruz, plus agglomerated tailings from the milling of ores from these two operations.

Results of Geochemical Testing. AGMJV has previously conducted geochemical testing of waste materials from the Padre Madre and American Girl Canyon mine operations (SRK, 1988, 1989). These tests have shown little potential to generate acid or leach metals or other constituents at concentrations of concern for waste characterization or water quality. Monitoring of data from mining, milling and heap leaching operations at Padre Madre and American Girl Canyon has shown similar results.

From exploration work, the geology and mineralization at Oro Cruz is anticipated to be very similar to that at Padre Madre and American Girl Canyon. Geochemical testing was conducted on waste materials specific to the proposed Oro Cruz operations to determine the potential effects from Oro Cruz mining, processing and waste disposal. Testing results are summarized from WWL (1992).

Mill Tailings. High-grade Oro Cruz ore would be milled at the American Girl Canyon mill using the same crushing, grinding, and cyanide leach and carbon adsorption process used for American Girl Canyon ores. Because of the recent change in WQCB policy, it was assumed that tailings would be agglomerated with heap ore and placed on the American Girl Canyon heap leach for disposal at the time of heap closure.

The geochemical test results summarized above on samples of simulated Oro Cruz tailings indicate the following.

- *The Oro Cruz tailings would be similar in geochemistry to the American Girl tailings tested in SRK (1988, 1989).*

TABLE 35

MATERIALS PLACED ON AMERICAN GIRL CANYON HEAP LEACH

	Year	Millions of Tons
Heap Leach Ore:		
American Girl Canyon	(1989 through 1992)	3.36
American Girl Canyon	(1993)	0.65
Oro Cruz	(1994 through 1996)	2.34
	Subtotal	**6.34**
Tailings to be Used in Agglomeration:		
American Girl Canyon	(1993 through 1994)	0.50
Oro Cruz	(1993 through 1997)	0.62
	Subtotal	**1.12**
Agglomeration Additives:		
Cement and Polymers	(1993 through 1997)	0.14
TOTAL MATERIALS ON HEAP LEACH		**7.60**

- *From the California Waste Extraction Test (WET) test results, the Oro Cruz tailings would be classified as a Class C (inert) waste under former WQCB policy.*

- *The Oro Cruz tailings would not be acid generating, and would have a strong net acid neutralization potential.*

- *From the EPA Method 1312 tests, the Oro Cruz tailings would not leach metals or other constituents of concern for contamination of surface water or groundwater.*

- *The Oro Cruz tailings would be suitable for agglomeration with heap ore at the American Girl Canyon heap leach.*

Spent Ore. Oro Cruz ore would be leached on the American Girl Canyon leach pad using the same crushing, cyanide leach and carbon adsorption recovery process used for American Girl Canyon ores. The ore would be adjusted for pH with calcium oxide for leaching, then rinsed with fresh water for removal of cyanide during heap decommissioning. The key geochemical phases of the heap are during leaching (where the pH is maintained at acceptable levels) and after heap decommissioning (where the heap is rinsed and pH reaches an equilibrium based on the residual buffering capacity of the rinsed, spent ore). The geochemical testing program for the Oro Cruz spent ore was organized to evaluate these two phases.

The geochemical test results summarized above on samples of simulated Oro Cruz spent ore indicate the following:

- *The Oro Cruz spent ore would be similar in geochemistry to the Padre Madre spent ore tested in SRK (1989).*

- *From the California Waste Extraction Test (WET) test results, the Oro Cruz spent ore would be a Class C (inert) waste.*

- *The Oro Cruz spent ore would not be acid generating in either its initial or rinsed condition, and would have a strong net acid neutralization potential.*

- *From the EPA Method 1312 tests on rinsed samples, the Oro Cruz spent ore would not leach metals or other constituents of concern for contamination of surface water or groundwater.*

Waste Rock. Non-mineralized and sub-economic rock from the proposed Cross and Queen pits and development rock from the Cross underground mine would be disposed of at three designated sites in the Oro Cruz area (two small development dumps south of the Cross pit and the primary waste rock dump northeast of the Cross pit). Waste rock would be hauled by truck and end dumped at the sites, which are located outside of major washes and floodplains in the area.

The geochemical test results summarized above on samples of Oro Cruz waste rock indicate the following:

- *The Oro Cruz waste rock would be similar in geochemistry to the American Girl waste rock tested in SRK (1988, 1989).*

- *The Oro Cruz waste rock would have very low to no detectible total sulfur, is not acid generating and would have a strong net acid neutralization potential.*

- *From the EPA Method 1312 test the Oro Cruz waste rock does not leach metals or other constituents of concern for contamination of surface water or groundwater.*

- *From the California WET test results on selected samples, the Oro Cruz waste rock would be a Class C (inert) waste.*

- *The Oro Cruz waste rock would be suitable for surface disposal without special lining or covering requirements.*

RCRA Regulations. Adherence to or consideration of Resource Conservation and Recovery Act (RCRA) regulations for the American Girl Project mine waste containment is not required. Mine wastes have been excluded from regulation under RCRA by the Bevill Amendment. Even if the wastes were regulated under RCRA, the wastes would not be likely to be classified as hazardous since geochemical testing of the wastes has shown that leachate concentrations would not meet hazardous criteria according to the California WET test.

Impact Mitigation. AGMJV has proposed environmental protection measures (see Chapter 2) to reduce potential adverse effects. No additional mitigation measures would be required.

Residual Effects. The modification of the Oro Cruz area due to development of open pits and waste

rock dumps would introduce unnatural landforms to the area. This would result in a direct, long-term adverse impact to topography, and geological resources which cannot be mitigated with the proposed action. All impacts are not significant.

Surface Water Hydrology

Runoff and Sedimentation. Construction of the proposed mine pits and waste rock dumps in the Tumco Wash valley would alter the current drainage patterns in the immediate vicinity of these features. Due to the limited periods of surface runoff in the site area (occurring only during major storm events) the impact of proposed Oro Cruz operations on site runoff and sedimentation would be insignificant.

Floodplains. The limits of the proposed mine pits and waste rock dump in the Tumco wash would be outside of the 100-year floodplain. Therefore, the impact of proposed Oro Cruz operations on major storm runoff and erosion would not be significant.

Surface Water Quality. A potential impact of mine waste materials and exposed mineralized areas on surface water quality would be the leaching of constituents from these materials into surface water. There are no indications that leaching has caused any identifiable impacts at the Padre Madre and American Girl Canyon operations.

As noted above, waste rock and ore from Oro Cruz would be similar in mineralization and alteration to that found in American Girl Canyon operations. Leach tests of selected samples of Oro Cruz waste rock, tailings, and spent ore have been conducted to represent precipitation leaching conditions (WWL, 1992a). The test results show that these waste materials do not produce leachate with concentrations of environmental concern. Due to the favorable leaching characteristics of the waste materials and the limited precipitation leaching of these materials, the impact of Oro Cruz operations on surface water quality would not be significant.

Acid Rock Drainage. An additional impact of mine waste materials and exposed mineralized areas on surface water quality would be by oxidation of pyrites and related iron-bearing sulfides followed by leaching of constituents from these materials into surface water. Due to the oxidized nature of the minerals, this has not been an issue of concern for the Padre Madre and American Girl Canyon operations, and ore and waste rock from the proposed Oro Cruz operation would be similar in degree of oxidation.

As discussed in the Geology and Geotechnical section in this Chapter, the potential for acid generation from waste rock and exposed mine pit slopes, tailings, and spent ore from Oro Cruz samples has been estimated by assessing static acid generation properties. The test results show that these materials have a very low sulfur content (and related acid-generating sulfide content), and have a neutralization potential significantly higher than acid generation potential. Tests on these materials show a net neutralization capacity. Therefore, the impact of Oro Cruz operations on surface water quality from acid generation would not be significant.

Impact Mitigation. There are no identifiable adverse effects which would require mitigation.

Residual Effects. Residual adverse effects are negligible.

Groundwater Hydrology

Groundwater Withdrawal. Groundwater withdrawal for proposed Oro Cruz operations would be limited to makeup water required for milling and heap leach processing, and water required for mining operations. After use of water pumped from historic underground mine workings, the makeup water for processing would be supplied by the existing American Girl project well southwest of American Girl Canyon. This well has provided makeup water for the existing Padre Madre and American Girl Canyon operations with no significant or irrecoverable drawdown of groundwater levels. Processing of Oro Cruz ore would not require higher pumping rates that those currently used for American Girl Canyon operations.

Water required for mining operations include water for dust suppression on the proposed Oro Cruz haul road and water for underground drilling. This would require minor quantities of water, supplied by surface runoff previously collected in underground workings or by the American Girl project well. No withdrawal of groundwater would take place in the Tumco wash. The impact of proposed Oro Cruz operations on groundwater levels in the site area would not be significant.

Groundwater Inflow to Mine Pits. The depths of open-pit mining in the proposed Cross and Queen pits would generally be above the levels of groundwater encountered in Oro Cruz exploration holes. Groundwater inflows into the mine pits would be nonexistent or limited to minor seeps (such as those encountered in the mine pits in American Girl Canyon).

Groundwater Quality. As mentioned in Chapter 3, groundwater withdrawn from the unconsolidated sediments southwest of the project site is suitable for ore processing but does not meet EPA secondary drinking water standards. Groundwater flow in the region is toward the northwest.

As discussed in the Geology and Geotechnical section in this Chapter, leach tests of samples of Oro Cruz waste rock, tailings, and spent ore show that these waste materials do not produce leachate with concentrations of environmental concern. Due to the favorable leaching characteristics of the waste materials and the limited precipitation leaching of these materials, the impact of proposed Oro Cruz operations on groundwater quality would not be significant.

Proposed Oro Cruz operations may impact groundwater by accidental leakage of solutions from the American Girl Canyon heap leach facility (from the existing lined leach pad or lined ponds). Four monitoring wells have been installed by AGMJV adjacent to and downgradient from the American Girl Canyon heap leach facility according to permit requirements of the California WQCB. These wells were installed to monitor performance of the leach pad and ponds. Water levels and water quality data from these wells have shown no impact from the heap

leach facility. The impact on groundwater quality of leaching Oro Cruz ore on the existing American Girl Canyon leach pad would not be significant.

Impact Mitigation. There are no identifiable adverse effects that would require mitigation.

Residual Effects. Residual adverse effects would be negligible and not significant.

Soils

Direct and Indirect Impacts. Impacts to soils from proposed mining activities would consist of changes in structure, texture and substrate conditions due to the removal or covering of the natural soil surfaces. The present undisturbed surfaces are a mixture of in-place rocky soils, alluvial toe slopes and outwash fans, and old piedmont surfaces with desert pavement plus previously disturbed surfaces. The slope and upland soils are generally dry, thin veneers that support low plant cover and productivity; the desert pavement surfaces are similar but with even less plant cover. The alluvial toeslopes and outwash soils are the most productive habitats for plants and animals.

The surfaces that would be left from proposed mine pits are generally similar to rock outcrop and steep slopes, and the substrates would weather and support a rock and upland shrub vegetation type. The mine waste dumps, haul roads and facilities surfaces would be mixed rock substrates of in-place soils and hauled materials that would be graded to resemble presently occurring mixed substrate soils. During reclamation, the mine waste dumps would be worked into loose surfaces of partially broken, unweathered rock substrates. These would support a combination of wash and upland plant communities. The composition of these communities would depend on the final contouring and drainage basins. Current revegetation testing of the mine waste dumps show that these substrates are fertile and can support good plant germination and growth depending on how surface water runs off and is collected into the graded basins. There would be no heaps of leached ore or extensive surface facilities at the Oro Cruz site, since the ore would be hauled to the American Girl facilities for leaching, and the existing mill, shops and offices would remain located in the American Girl Canyon area.

The changes in the soil as a plant growth substrate would result in a short-term decrease in vegetation cover in the mine pit areas. These surfaces have been observed to revegetate without reclamation as naturally dispersed seeds germinate and become established. The access roads and ramps in the pits would be revegetated to a mixed plant community type. The proposed Cross pit would be allowed to store water. This could potentially create a small seasonal wetland.

On the mine waste dumps, the surfaces are being successfully revegetated at the Padre Madre area when rainy periods such as the 1991-1992 winter season occur. These substrates are fertile and hold good moisture for plant growth. The same fine grading and revegetation techniques would be employed on the proposed mine waste dumps at the Oro Cruz area. This would provide conditions for an eventual increase in plant cover and productivity as compared to the present condition of historic disturbance and dry upland slopes.

Impact Mitigation. There are no identifiable adverse effects that would require mitigation beyond those measures incorporated into the proposed action.

Residual Effects. Residual adverse effects would be negligible and not significant.

Vegetation

The direct impacts to vegetation would primarily be caused by the removal of the vegetation due to mining of pits and construction of mine waste dumps, roads and other facilities at the proposed Oro Cruz operation area. Secondary impacts due to wind or water erosion potential or changes in surface water drainage in this extremely dry climate would be none to minimal. In those areas to be developed, suitable perennial plant specimens would be salvaged for transplanting, with the remaining plants damaged or destroyed by developmental activities. Seeds would also be salvaged by surface soil removal before development. Therefore, the main impacts would be removal or destruction of vegetation cover and loss of productivity for the duration of the mining activities and for a period of time after completion of mining. Since the ore would be hauled to the American Girl Canyon operation for leaching and milling at facilities already in place, little additional area would be impacted by processing activities. Impacts to the existing vegetation are affected by the extent of new disturbance, the short-term effects, effects on sensitive species or unique habitats, and long-term changes in the vegetation after reclamation.

Extent of Disturbance. In the Oro Cruz main operational area, the proposed pits would take 40 acres of which about 30 acres were previously disturbed by historic mining, recent mining exploration and recreational use. The proposed development and mine waste rock dumps are estimated to take 56 acres of which approximately 25 acres were previously disturbed, and the haul roads to the dumps would take 5 acres, all of which have previously been disturbed. The ore haul road corridor to the American Girl site would be about 50 acres in extent; however, actual road construction activities would disturb 15 acres, of which 2 acres are already disturbed by historic roads. The 40 acres proposed as an aggregate source have all been previously disturbed. Therefore, the total estimated disturbance would be 156 acres, of which 54 acres have not been previously disturbed and 102 acres have been previously disturbed by mining or other activities. Some of this historically disturbed acreage has become partially re-established with vegetation. All vegetation types identified within Chapter 3 would be affected by the proposed Oro Cruz operation, although the shrub-slope/outcrop vegetation type would be most affected. The percentage breakdown of potential Oro Cruz disturbance by vegetation type is estimated as follows:

- *Shrub - alluvial: 26 percent*
- *Shrub - desert pavement: 16 percent*
- *Shrub - slope/outcrop: 50 percent*
- *Wash - shallow: 2 percent*
- *Wash - deep: 6 percent*

There is no anticipated increase in disturbed acreage in the American Girl area from the proposed Oro Cruz activities.

Short-Term Effects. The short-term effects on the vegetation would be removal of vegetative cover and

loss of plant productivity, hence animal habitat, for the duration of the mining activities. During this active mining period there would be a temporary loss of 54 acres of currently undisturbed vegetation and habitat. This vegetation is in poor condition as a biological resource at the present time. Historic mining and recent exploration activities, in addition to the dry climate, have left many bare areas or low plant cover of less than 2% in rocky and steep substrates. The more productive wash vegetation has largely been previously disturbed and little additional wash habitat would be removed during the mining.

Sensitive or Unique Species. There are no sensitive or unique plant species or vegetation types on the proposed Oro Cruz site or along the proposed haul road corridor. There are no springs or wetlands in this desert area, and the plants and vegetation types are common and widespread in the Colorado Desert of southeastern California. There are no populations of fairy duster on the proposed operational site or road corridor. Noxious weeds do not occur in this dry desert climate, and would not be expected to be introduced during reclamation based on observation of plants now growing on historically disturbed sites in the Tumco Wash and naturally revegetating current disturbances at other mine sites including Padre Madre.

Long-Term Effects and Potential for Reclamation. The long-term effects on the vegetation would be a change in species composition and an eventual restoration of productive vegetation types. Testing of revegetation methods (including which plant species can be successfully transplanted and seeded) is presently being conducted on the Padre Madre operation area. Results of the first three years of testing show that the effects of mining disturbance can be reduced by the proposed revegetation and reclamation measures incorporated into the proposed action. AGMJV would restore plant cover and productivity by selective seeding of local garden plots that would act as sources of seeds for continued natural succession. As a result of natural succession and the transplanting/seeding efforts, the eventual revegetation would consist of a vegetation that approaches or exceeds the original plant cover and densities. The vegetation that becomes established would depend on the topography, drainage, and substrate conditions of the final reclaimed surfaces, and subsequent weather patterns over the next several decades. As a result of micro-topographic changes, the vegetation composition would be a mixture of wash and upland species on the reclaimed surfaces. The establishment of catchment basins on the surfaces of the proposed dumps and haul roads in the Oro Cruz site would allow wash and upland plants to persist until more natural drainages and erosion patterns are formed over time. Complete re-establishment of revegetation would take 200-300 years or more, depending upon the topography and available moisture. Therefore, impacts to vegetation would be long-term in nature.

Impact Mitigation. AGMJV has proposed environmental protection measures (see chapter 2) to reduce potential adverse effects. No additional mitigation measures would be required.

Residual Effects. The proposed operational area would directly disturb about 156 acres (of the 191-acre total operational area) which support creosote bush scrub habitat dispersed over about 2-5 percent of

the land. The loss of habitat for wildlife in most of this area would be a residual and unavoidable adverse effect of the proposed operation. However, given the larger contiguous acreage of desert habitat in unmineralized areas, and phasing of the overall American Girl Project, this impact would not be significant. Some natural revegetation supplemented by transplanting and seeding would occur at the end of operations to return some of the disturbance to vegetated conditions.

Wildlife

The general types of impacts to wildlife which would result from the proposed Oro Cruz development and operation include changes in wildlife habitat, direct mortality, displacement and exposure to cyanide. Each impact type is discussed below. These discussions are then followed by descriptions of possible impacts to each type of wildlife species.

Wildlife Habitat. The Oro Cruz operation would directly disturb an estimated 156 acres of wildlife habitats in Tumco and American Girl Washes for the long-term. About 65 percent of these habitats have been previously disturbed by historic mining or other activities. Some previously disturbed areas (e.g., the Golden Queen and Cross Mines) represent some of the most sensitive and important wildlife habitats in the Oro Cruz area. Fencing and the subsequent restriction of some wildlife movements would result in additional reduced availability of habitat. Other nearby historic mines, which also provide important habitat for a number of sensitive bat species and other wildlife, could be damaged or destroyed as a result of mine blasting and vibration. Thirty-five of the 191 acres in the project area are not wildlife habitat due to historic mining activities.

Direct Mortality. Concomitant with habitat losses, proposed Oro Cruz development would result in the direct mortality of some less mobile wildlife species inhabiting development areas. All herpetofauna and most mammals using burrows would be the primary wildlife groups affected. While mine-roosting bats would also be susceptible to this type of impact, historic underground workings would be almost entirely cleared of bats and sealed (both to the extent possible) to avoid most direct mortality. Additional direct impacts to wildlife would occur during the operating life of the mine as some wildlife are occasionally crushed on haul roads. Off-site, mining-related impacts would be primarily confined to wildlife mortality on the higher speed mine access road and high speed regional roads (e.g., Ogilby Road and Interstate 8) that mine employees use for commuting. Because no appreciable change in the current American Girl Project work force is anticipated, there should be no off-site losses directly associated with increased housing demand or infrastructure requirements.

Displacement. Most wildlife present in and around the proposed operation area would be displaced, to some degree, from active mining areas. The degree of displacement, or the width of the buffer zone that is established, would depend upon the seasonal sensitivity of wildlife and their tolerance of, and adaptability to, this type of disturbance. For example, most herpetofauna (reptiles and the red-spotted toad) would use suitable habitat immediately adjacent to, and even inside, many mining areas, while mule deer would be expected to be displaced to adjacent

drainages during daylight hours. While the noise from American Girl sonic canons can be heard miles away from the existing pregnant ponds, wildlife habituate to this disturbance outside of the immediate impact area. Since the proposed Oro Cruz operation would use existing American Girl Canyon facilities, (sonic canons, heavy equipment, and facilities associated with the ore crushing, mill, and heap leaching operations), acoustic disturbances in Tumco Wash would be lower than those at the American Girl Canyon operation.

Cyanide Exposure. Open water is highly attractive to desert wildlife. This attraction can be fatal if wildlife are exposed to cyanide solutions in the ponds, ditches, and other toxic areas associated with the heap leaching process. More information on cyanide hazards is provided in the Potential Hazards from use of Cyanide in Ore Processing section later in this Chapter of the EIS.

All cyanide leaching of Oro Cruz ore is proposed to occur at the existing American Girl Canyon heap leach facility. Wildlife mortality around the American Girl Canyon and Padre Madre cyanide hazard areas is monitored on a daily basis and results are reported monthly to the BLM.

As shown in Figures 36 and 37, AGMJV experienced a significant number of wildlife deaths on the pad, barren and pregnant ponds, and solution ditches at both the Padre Madre and American Girl Canyon heap leach facilities over the 1990-1992 period. About 90 percent of mortalities consisted of avian (bird) species at both facilities.

Mortality at the Padre Madre heap leach has been substantially reduced since 1990 because the heap leach facility is being closed and will soon be de-commissioned. From the period 1987 through 1992, 249 wildlife deaths at Padre Madre were reported to BLM. Of these deaths, 18 percent occurred at the ponds, 33 percent at the ditches and 44 percent at the pad. Mortality in 1993 was 5 specimens.

At American Girl Canyon, 324 wildlife deaths were reported to BLM over the 1990-1992 period. Of these deaths, 21 percent occurred at the ponds, 44 percent at the ditches and 30 percent at the pad. Deaths were highest at the pad in 1990 and 1991, but pad deaths were reduced to 0 in 1992. However, deaths at the ditches increased substantially in 1992 over previous years. Mortality in 1993 was 11 specimens, a substantial reduction from previous years.

Cyanide-related animal mortality has been identified by BLM as a significant issue at both the existing American Girl Project operations and the proposed Oro Cruz operation. Additionally, deaths of migratory birds are prohibited by the Migratory Birds Treaty Act.

In consultation with BLM, AGMJV has recently undertaken additional measures to protect wildlife from cyanide exposure. These measures include upgrading of netting at ponds, additional net covering at pond perimeters, enclosing solution in pipes rather than open ditches, and increased use of sonic guns to

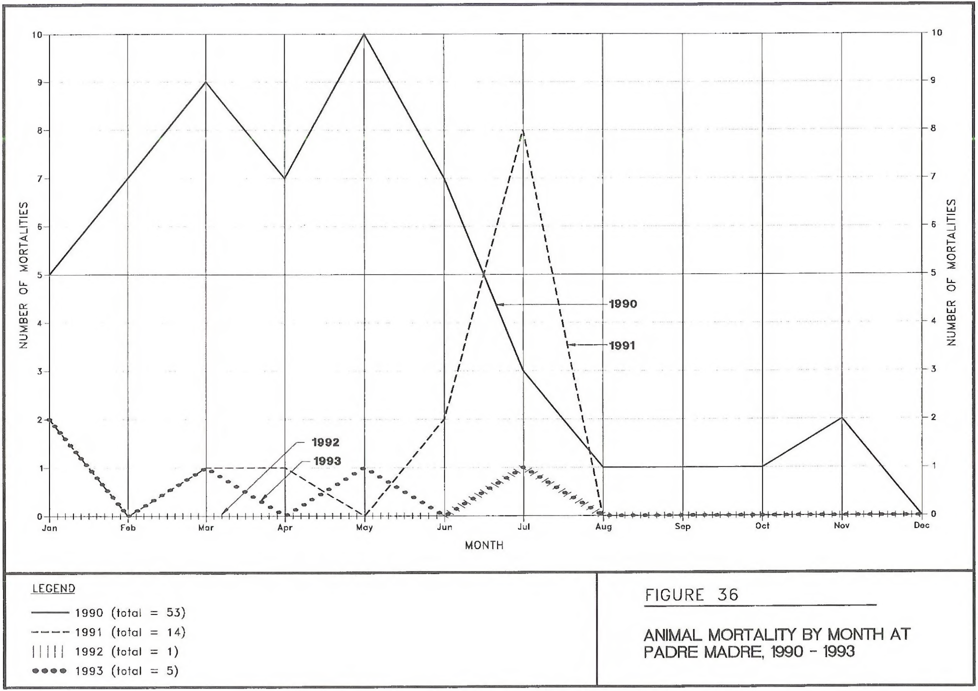
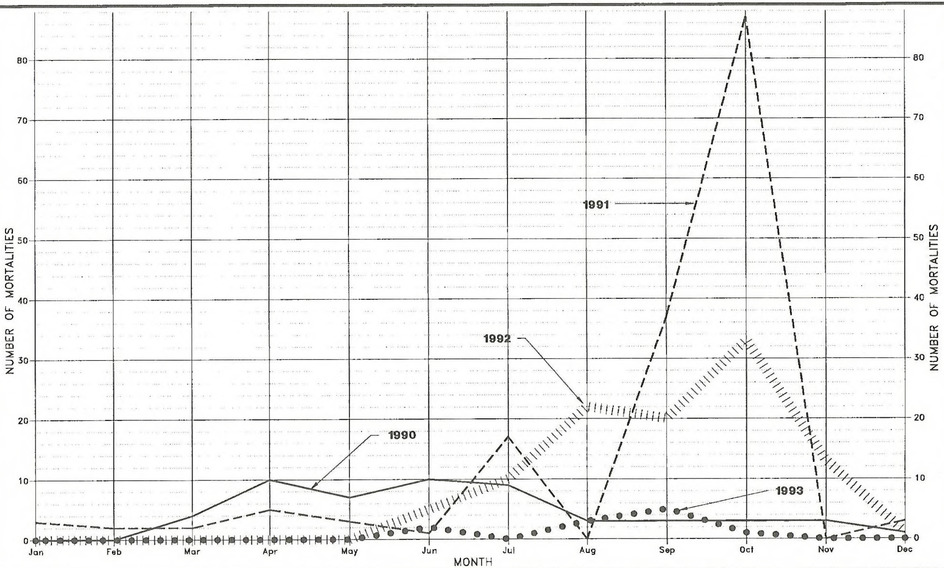


FIGURE 36

ANIMAL MORTALITY BY MONTH AT PADRE MADRE, 1990 - 1993



LEGEND

- 1990 (total = 53)
- 1991 (total = 160)
- 1992 (total = 104)
- 1993 (total 11)

FIGURE 37

ANIMAL MORTALITY BY MONTH AT AMERICAN GIRL CANYON, 1990 - 1993

scare away wildlife. Three alternatives (Alternative 3, Alternative 4, and BLM's preferred alternative) have been developed in this EIS to evaluate different approaches to cyanide management and control.

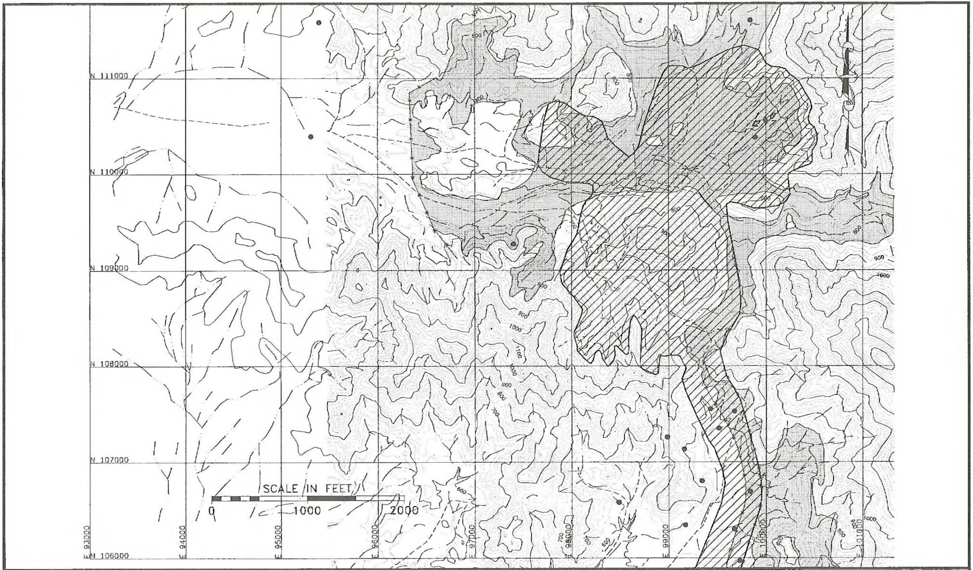
The 2" mesh netting currently installed at the Padre Madre and American Girl Canyon operations was considered "state of the art" at the time of installation. AGMJV has proposed to replace the present netting with a mesh size of 1" x 1" if Oro Cruz is approved. Netting of similar mesh has proven very effective at excluding wildlife at other mine sites (Hallock, 1992). The reduction in netting mesh size and other recent measures taken by AGMJV should continue to reduce wildlife mortalities from cyanide. However, the ultimate success of these measures can only be proven over a period of time. If existing and proposed measures do not prove to be effective, impacts would be significant and AGMJV would be required to take further steps to eliminate wildlife mortality.

Threatened, Endangered, Candidate, and Sensitive Species. Of the nine Federal or State threatened, endangered, and candidate species present, or potentially present, on the proposed Oro Cruz area (see the Wildlife section in Chapter 3), all but the flat-tailed horned lizard, which is not known to be present in the area, would be adversely affected by the proposed operation to some degree. In addition, four California "Species of Concern" (CSC) are at least seasonally present in the proposed Oro Cruz area and would be similarly affected. Effects would include displacement from habitats adjacent to mining areas for the life of the proposed Oro Cruz operation and direct mortality.

To comply with the Endangered Species Act of 1973 (ESA), as amended, the BLM must address the affects the project would have on listed species in a Biological Assessment (BA). A BA has been prepared by BLM and submitted to the U.S. Fish and Wildlife Service (USFWS). Impacts to listed species identified in the BA are discussed below.

Desert Tortoise. Figures 38 through 40 show the location of proposed Oro Cruz facilities within desert tortoise habitat. Development of the proposed Oro Cruz operation would result in the short-term displacement of a low number of desert tortoises from a small area of disturbed and undisturbed habitat in Tumco and American Girl Washes, short-term restriction of movements and habitat insularization, the long-term loss of disturbed habitats, harassment and possible direct mortality, the reclamation of disturbed habitats, and the compensatory acquisition of desert tortoise habitat in a desert tortoise management area at the ratio of one acre acquired for each acre disturbed. An estimated 87 acres of desert tortoise habitat would be disturbed by the proposed operation. Tortoises in an additional 159 acres would be relocated to adjacent areas for their protection. This would require acquisition of 246 acres of compensatory BLM Category 1 habitat in a desert tortoise management area.

Section 9 of the Endangered Species Act (ESA) prohibits the take of listed species without special exemption. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation resulting in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering.



POTENTIAL DESERT TORTOISE HABITAT

ORO CRUZ OPERATION AND HAUL ROAD CORRIDOR

PROPOSED TORTOISE PROOF FENCING LOCATIONS

RECENT TORTOISE SIGN LOCATIONS

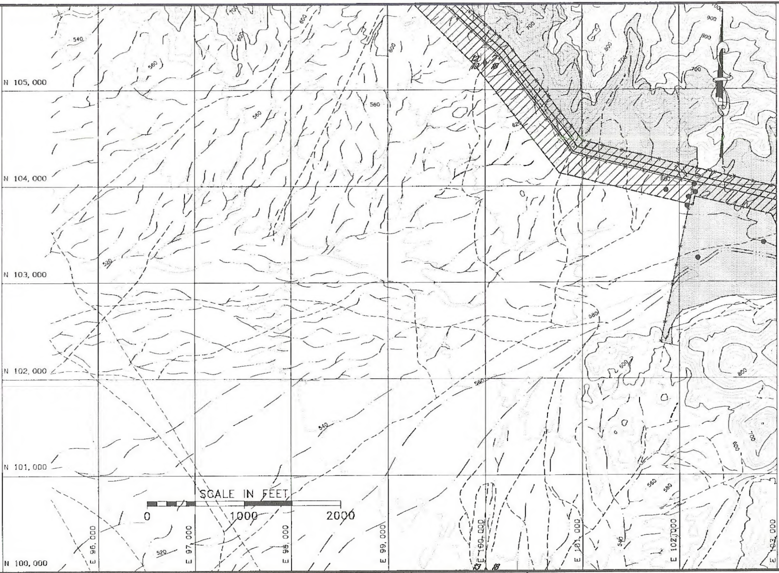
KEY

1

2 3

FIGURE 38

DESERT TORTOISE HABITAT, TORTOISE SIGN LOCATIONS, AND PROPOSED FENCING LOCATIONS - UPPER ORO CRUZ CORRIDOR



POTENTIAL DESERT TORTOISE HABITAT

ORO CRUZ HAUL ROAD CORRIDOR

PROPOSED TORTOISE PROOF FENCING LOCATIONS

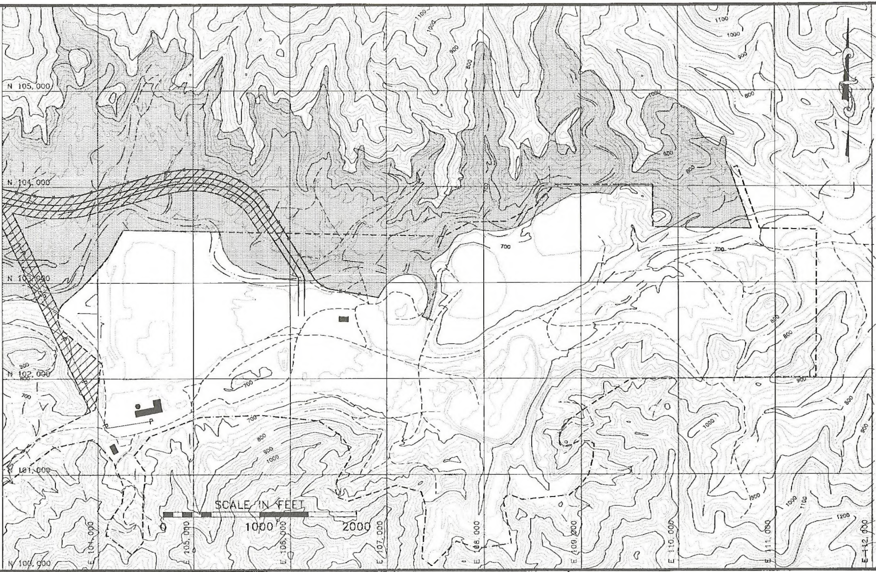
RECENT TORTOISE SIGN LOCATIONS

KEY

1	
2	3

FIGURE 39

DESERT TORTOISE HABITAT, TORTOISE SIGN LOCATIONS, AND PROPOSED FENCING LOCATIONS - MIDDLE ORO CRUZ CORRIDOR



DESERT TORTOISE HABITAT

ORO CRUZ HAUL ROAD CORRIDOR

PROPOSED TORTOISE-PROOF FENCING

KEY

1		
	2	3

FIGURE 40

DESERT TORTOISE HABITAT AND PROPOSED TORTOISE FENCING - LOWER ORO CRUZ CORRIDOR

Under terms of the ESA, taking that is incidental to an agency action can be authorized by the USFWS under the ESA, provided that such taking would not jeopardize the continued existence of the species.

The following levels of incidental take may occur in association with the proposed action, based on the mining proposal and the implementation of recommended mitigation measures:

- *Up to six desert tortoises may be accidentally killed by haul trucks or other mining-related activities.*

- *Up to twenty desert tortoises may be harassed as a result of moving them out of harms way along haul roads or the mine access road.*

Tortoises within affected areas and remaining undisturbed areas of inadequate size would be captured and relocated to adjacent areas during pre-construction clearance surveys. This may reduce tortoise survival probabilities of relocated individuals if they cannot adapt to alternate habitats or of existing tortoise residents affected by relocations of new tortoises. Additional tortoises outside of restrictive mine fences would be displaced from the mining area for the short-term life of the project.

Although tortoise habitats disturbed by mining would be reclaimed, it would be decades before habitats are restored to former values. The majority of Tumco Wash habitats have been disturbed by historic mining and are presently suitable only for tortoise movements (i.e., they have little or no foraging or safe denning values). The additional loss of habitats, even though they may be presently unoccupied, would protract the recolonization of tortoises in Tumco Wash. The proposed haul road from the Tumco Wash/ American Girl Wash saddle south to the American Girl Canyon facilities would also result in the long-term loss of habitat (24 acres). While this impact is still relatively minor (because the disturbance associated with this 3 mile corridor is linear, only 100 feet wide, and is surrounded by large areas of undisturbed habitat), the impact would disturb intact, viable tortoise habitat.

A few tortoises may also be vulnerable to direct, accidental mortality during the development and operational phases of the mine. However, as noted above, tortoises located during pre-clearance surveys would be captured and relocated to adjacent areas. Tortoise-proof fencing should restrict tortoises from accidental crushing in active mining areas and along haul roads, however, the occasional tortoise has been known to circumvent these barriers. With mitigation, these impacts would not be significant.

California Leaf-nosed Bat. The proposed operation would result in the permanent loss of the Golden Queen and Cross Mine roosts, the loss of roosts in additional smaller mines and drifts, possible, accelerated deterioration of adjacent mine roosts, limited direct mortality, and the long-term loss of foraging habitats. AGMJV would be required to minimize losses, protect important, adjacent *Macrotus* habitats, attempt to replace lost habitats, and conduct studies to learn more about pertinent life history requirements.

The destruction of the historic Golden Queen Mine would be a significant wildlife impact associated with

the proposed operation. This mine is the largest and most important maternity and winter roost in Tumco Wash and the second most important known *Macrotus* roost in the Cargo Muchacho Mountains. Approximately 72-125 adults have used the Queen as a maternity roost in recent years and 68 to 150 bats have been counted using the mine as a winter roost. Destruction of this mine would result in the permanent loss of the maternity roost, and the short-term to permanent loss of winter, summer and night roost habitat (depending if any existing shafts remained following mining). The worst case scenario, the permanent loss of all present bat use, would result from the collapse and permanent blockage of both existing shafts. At best, if the current vertical shaft remained following mining, bats would lose the use of the historic workings for the life of the operation, but summer (use by males only), winter, and night roost use would continue if underground workings were still intact and accessible. The present maternity roost near the surface of the Queen mine would still be destroyed by mine operations and permanently lost.

The Cross Mine is not presently an important *Macrotus* habitat, although other species of bats use it, as do low numbers of *Macrotus* for nightly and other seasonal roosts. Other, smaller historic mine workings in the impact area are also similarly used by low numbers of *Macrotus*. While none of the mines to be impacted, other than the Queen, can individually be considered an important *Macrotus* habitat, they each provide alternative habitat and cumulatively contribute to the ability of the species to survive in this area.

Only a low number of *Macrotus* would be directly killed by the proposed mine development. Immediately before mining, or at an appropriate time of year, bat biologists would close entrances to all mines that would be destroyed after bats have emerged for evening foraging. Biologists would then enter mines, as safety permits, and attempt to capture remaining bats. In this way, most bats present would be removed from the mines before their roosts are destroyed.

Another potential, direct mortality source to bats is cyanide poisoning at the existing American Girl Canyon and Padre Madre leach pads, pregnant solution ponds and ditches. Although ponds and ditches are now completely covered (including sides) with restrictive netting, Tumco *Macrotus* foraging or seasonally moving to roosts in the vicinity of these facilities could potentially be exposed to this mortality source. Although bats are already exposed to this potential hazard, bats would experience a longer exposure with Oro Cruz operations (see further discussion of impacts from cyanide below).

The proposed operation would also result in the long-term loss of some of the most important *Macrotus* foraging habitats in Tumco Wash, the deep wash vegetation and the less vigorous vegetation in the broad wash bottom. Approximately 11 acres of wash vegetation occurs in Tumco Wash, proper. Additional wash vegetation extends west onto the outwash plains where Tumco Macrotus are known to forage. The layout of the proposed Oro Cruz operation would minimize impacts to wash vegetation. However, approximately 1.27 acres (18%) of the existing Tumco wash vegetation would be destroyed by two haul road crossings and the main waste dump. Additional undisturbed wash vegetation would occur within the operations area. The loss of this habitat

would reduce local Macrotus foraging opportunities; however, it is unknown if this loss would result in a numerical decline in adjacent roost use. A limited amount (< 1 acre) of wash vegetation would also be lost in the American Girl Wash where the haul road would cross the wash. A great deal of wash vegetation has already been lost to the existing American Girl Canyon aggregate extraction operations. It is unlikely that any additional wash vegetation would be lost in the proposed aggregate mining area west of Padre Madre.

It is likely that *Macrotus* displaced from impacted mines would initially relocate in adjacent mines. The Mesquite, Golden King, and Golden Crown would continue to be the most important remaining nearby mines, although other mines might also be used. All these mines provide winter, summer, and nightly roosts for at least a portion of the population. The two latter mines support small maternity roosts. It is possible that bats displaced from the Queen could be physically accommodated in these adjacent mines without adverse affect.

It is uncertain how the loss of prime foraging habitat would affect the bat's prey base. If remaining foraging habitat in Tumco Wash is inadequate to support the present *Macrotus* population, and that of other bat species, adequate seasonal roost availability may be inconsequential. In the event that prey availability, not roost availability, dictates bat numbers in Tumco Wash, the proposed action might result in some local, long-term reduction in bat numbers until the vegetative community and prey base is restored. Initially, excess bats displaced from Tumco Wash would be forced to find alternate foraging areas that have suitable roosts within their nightly cruising radii. The carrying capacity of an unknown amount of these adjacent habitats may already be supporting a maximum number of *Macrotus*.

Impacts on *Macrotus* from the proposed action would be significant. These impacts would be greater than the impacts to *Macrotus* associated with the existing American Girl Canyon and Padre Madre operations.

Other Sensitive Candidate Bats. The spotted bat, California mastiff bat, cave myotis and Townsend's big-eared bat are federal candidate species known or suspected of occurring in and around the American Girl Project area. The latter 3 species are also CSC species. All are thought to be uncommon in the area. While none of these species are known to use the mines that would be directly impacted by the proposed operation, evidence suggests low, intermittent or occasional use by cave myotis and Townsend's big-eared bat in some of the surrounding mines that would be indirectly affected by the operation. Habitats to be impacted by the operation are not known to be important to any of these species.

Other Sensitive Species. The remaining Federal and State sensitive species detected on the Oro Cruz area, including the Bell's vireo, loggerhead shrike, prairie falcon, and black-tailed gnatcatcher, would be displaced to adjacent suitable habitats during the seasonal to rare times that they are present in the area. Displacement would be long-term, until habitats disturbed by mining have been suitably reclaimed. This is not significant because of the minor impact to local habitat used by these species. Impacts would not jeopardize their survival.

Other Wildlife Species. The Proposed Action should have little or no impact on the mule (burro) deer because (1) present deer use is restricted to brief periods following heavy rains when more widespread water availability permits more extended movements into the Cargo Muchacho Mountains, and (2) these extended movements only rarely progress westward as far as the project areas in the American Girl and Tumco Washes. If deer movements did extend into these operation areas, impacts would generally be confined to the displacement of deer from fenced areas and additional diurnal displacement from surrounding disturbance areas. At most, this would result in briefer deer visits to this portion of these mountains. Potential hunting opportunities in drainages surrounding the project area would not change as a result of the proposed operation.

The proposed operation would have no impact on bighorn sheep and feral burros because they rarely wander into the Cargo Muchacho Mountains.

Amphibians, reptiles, and small mammals are discussed together because of similar habitat utilization and susceptibility to impacts. Members of these groups are terrestrial and spend a significant part of their lives in burrows (where they would be caught underground in an attempt to escape), making them susceptible to mine development and some mine operations (such as haul roads). While many of the specimens present in the proposed disturbance areas would be unavoidably killed principally during the development phase of the mining process, they are members of species that are common and widespread. Following mining, these species would recolonize disturbed habitats as their habitat affinities allow.

As discussed previously for the more sensitive bat species, other bat species in Tumco Wash would be adversely affected by destroyed roosting and foraging habitats, and displaced to adjacent areas in an attempt to find under-utilized habitat. Impacts would be relatively minor from a local, long-term population perspective.

Local avian and terrestrial predators would be affected by the Proposed Action via a reduced prey base, primarily in Tumco Wash. However, because the existing, low density prey base results in predator home ranges overlapping at least several local drainages, only a small portion of the overall home range of any local predator would be affected. Some habitats that would be affected are valuable to predators, but the operation area supports no available prey concentrations (some Macrotus roosts do represent unusual prey concentrations, but these roosts are generally unavailable to local predators, even to ringtails). Furthermore, these habitats are not unique and occur in all other drainages in the Cargo Muchacho Mountains. As a result, the local, moderate- to long-term prey base reduction associated with Oro Cruz development may affect an expansion of predator ranges, and a few ringtails inhabiting the Queen and Cross mines could be killed, but the proposed operation would not significantly affect the local predator population.

These other wildlife groups would be displaced from impact areas and narrow surrounding habitats for the short-life of the operation. They would return as habitat affinities and reclamation progression allow. There should be no significant direct mortality of these wildlife groups associated with the proposed action.

Impact Mitigation. To lessen impacts, BLM would require the following mitigation measures as a condition of permitting the proposed operation. These mitigation measures have been incorporated into the BA currently under review by the USFWS.

Mitigation measures for the desert tortoise include:

- *The BLM would ensure that 246 acres (246 acres of disturbance x 1.0 mitigation multiplier) of BLM Category 1 desert tortoise habitat be acquired by AGMJV in a tortoise management area. The deed to the purchased lands would be provided to the BLM within one year of commencement of Oro Cruz.*

- *The BLM would ensure that AGMJV completes desert tortoise pre-construction clearance surveys on all identified areas, prior to development activities commencing. A clearance survey would be completed under the direct supervision of a desert tortoise expert approved by the BLM and USFWS and would be completed after, or concurrent with, the placement of a desert tortoise exclusion fence. If the tortoise survey and removal occurs prior to the tortoise barrier being in place, an additional clearance survey would be conducted after the exclusion barrier is installed.*

- *All desert tortoise and other suitable burrows for this species within Oro Cruz permit area and clearance areas would be excavated. Desert tortoise that are encountered in the summer shall be held until temperatures are < 90°F and then released at the relocation site at an empty burrow or an artificial burrow, after appropriate information has been collected. Desert tortoise found during winter would be held in a cool place, yet protected from freezing temperatures, until the following spring when they would be released at the relocation site, after the required information is collected. The release site would be next to an empty desert tortoise burrow or an artificial burrow, and the animal would be placed in the shade of a shrub.*

- *The one tortoise thought to be present in the vicinity of the Crown Mine, would be relocated to the west side of the Tumco fence, in what is probably part of its home range.*

- *The 1-2 tortoises thought to be present in upper Tumco Wash would be relocated in the next drainage to the north, which is actually a tributary wash of Tumco Wash whose habitat is relatively intact and is thought to be presently occupied by at least one tortoise.*

- *The 2-3 tortoises thought to at least seasonally inhabit areas adjacent to the haul road corridor west of the existing American Girl Canyon fence would be relocated to the west side of the fence in what is thought to be part of their present home ranges.*

- *The one tortoise thought to be present north of the present American Girl Canyon operation and between the eastern and western security fences, would be relocated north of the haul road or west of the western fence, depending upon where the tortoise was initially located. The relocation site would also depend upon*

whether the tortoise expert considers the habitat north of the haul road fence adequate to support this tortoise.

- *The BLM would approve all release sites.*

- *Artificial burrows would be approximately five feet long and two feet deep at the distal end. The angle of decline for the burrow floor would not be more than 20° from the mouth to the distal end of the burrow. Other burrow dimensions may be used as deemed appropriate by a desert tortoise expert with prior BLM and USFWS approval.*

- *Desert tortoises that are relocated would be marked for future identification. An identification number (using the acrylic paint/epoxy technique) would be placed on the 4th costal scute (USFWS 1990). This identification number would include the formal consultation number of the Oro Cruz biological opinion. Additionally, a 35mm photograph (slide) of the carapace, plastron, and the 4th left costal scute would be taken. Notching would not be authorized.*

- *The BLM would ensure that AGMJV installs 1/2 inch diameter hardware cloth that is free-standing or attached to mine perimeter fencing to prohibit tortoise movements into hazardous areas, using current tortoise-proof fence specifications. Termini of each section of fence would be in topographic settings precluding tortoises from going around the end of the fence. The integrity of the tortoise-proof fence would be maintained for the life of the project by AGMJV and checked twice monthly and immediately after a precipitation event to ensure its integrity. In washes and other areas susceptible to flash-floods, "break-away" tortoise fabric may be installed. The segments would be loosely tied to the fence on higher ground, permitting them to "break-away" in the event of substantial surface flows.*

- *The existing AGMJV desert tortoise employee education program would be continued. Each new employee (including temporaries, contractors, and subcontractors) would receive the training/awareness program within the first two weeks of working at the mine. Employees would be advised of the potential impact to the desert tortoise and the potential penalties for taking a threatened species. At a minimum, the program would include the following:*

  - *Occurrence of desert tortoise and general ecology.*

  - *Sensitivity of the species to human activities.*

  - *Legal protection for desert tortoise.*

  - *Penalties for violation of Federal and State laws.*

  - *Reporting requirements.*

  - *Project features and mitigation measures designed to reduce the impacts to desert tortoises and promote the species' long-term survival.*

The continued and expanded use of desert tortoise awareness signs within the mining area (including Oro Cruz) would be required as part of this program. The program would be reviewed by BLM to assure completeness.

- *A Desert Tortoise Procedure Card would be developed to reflect the measures necessary to comply with the threatened status of the desert tortoise. The card would reflect the current status of the desert tortoise and the prohibition of take. The card would also identify the person(s) authorized to handle this species. All employees would be issued such a card.*

- *An authorized biologist (a professional biologist with demonstrated experience with techniques to locate desert tortoise and their sign and handle tortoises) would conduct the clearance survey(s) using methods approved by the BLM and USFWS. The biologist would have experience in marking (acrylic paint/ epoxy technique) desert tortoise for future identification. The biologist would provide a full report to the BLM and USFWS of all desert tortoise that are found and relocated. This information would include:*

  - *The locations (narrative and maps) and dates of observation.*

  - *General conditions and health, any apparent injuries and state of healing, and whether the animals voided their bladders when handled. Tortoises would be specifically examined for shell and upper respiratory tract disease.*

  - *Locations moved from and locations moved to (UTM coordinates).*

  - *Diagnostic markings (e.g., identification numbers or previously marked lateral scutes).*

- *AGMJV would designate a field contact representative (FCR) who would be responsible for overseeing compliance with protective measures for the desert tortoise and for coordination of compliance with BLM's stipulations following the clearance survey(s). The FCR would have the authority to halt all associated mining activities which may be in violation of the stipulation.*

- *The FCR would maintain a record of all desert tortoise encountered during project activities. This information would include:*

  - *The locations (narrative and maps) and dates of observations.*

  - *General conditions and health, any apparent injuries and state of healing, and whether animals voided their bladders when moved out of harm's way.*

  - *Locations moved from and locations moved to (UTM coordinates).*

  - *Diagnostic markings (e.g., identification numbers or previously marked lateral scutes).*

- *Evaluation of tortoise mitigation at the AGMJV project sites.*

Brief summary reports would be provided to the BLM on an annual basis for the life of the project. The FCR would receive specific training from the desert tortoise expert prior to handling any desert tortoise whose relocation would be necessitated by project activities.

- *Only persons authorized by the USFWS under the auspices of the Oro Cruz biological opinion would handle desert tortoises. The authorized person(s) would be approved by the USFWS prior to the onset of proposed mining activities. The BLM would submit the name(s) and credentials of the person(s) that would handle desert tortoise to the USFWS for review and approval at least five (5) days prior to the onset of mining activities.*

- *Any desert tortoise which is removed from harm's way along the access road to the mine site would be placed in the shade of a shrub or tree in the direction in which it was facing when found. Desert tortoises would be moved the minimum distance necessary to ensure their safety in this situation.*

- *Tortoises that are relocated or otherwise removed from the mine site would be handled in accordance with procedures as detailed in* <u>The Interim Techniques Handbook for Collecting and Analyzing Data on Desert Tortoise Populations and Habitats</u> *(June 1990), Chapter III, "Protocols for Handling Live Tortoises," which identifies specific handling techniques and precautions to be employed to protect the desert tortoise.*

- *AGMJV would purchase, post and maintain tortoise awareness signs along the access road to the mine. Sign installation would be to BLM and Imperial County standards.*

- *All trash and food items would be promptly contained within raven and coyote-proof containers and regularly removed from the project site to reduce the attractiveness of the area to tortoise predators.*

- *Employees would strictly limit their activities and vehicle(s) to the mining area and routes of travel which have been clearly marked. All employees would be instructed that their activities are restricted to areas within the perimeter fence. Parking and storage areas would only be allowed within the perimeter fence.*

- *Employees would inspect underneath parked vehicle(s) when within or immediately adjacent to desert tortoise habitat immediately prior to moving the vehicle(s). If a desert tortoise is beneath the vehicle, the authorized biologist or FCR would be contacted to remove the animal from harm's way.*

Mitigation measures for the California Leaf-nosed Bat would include:

- *To minimize direct mortality to Macrotus and other bats in the Golden Queen, Cross and other historic mine workings that would be*

destroyed by mining, bats would be cleared from the mines and excluded as close to the initiation of mining as possible, and within specified spring and fall periods to allow bats to relocate to alternate roosts during non-critical time periods. AGMJV would continue to work closely with qualified bat biologists and follow their recommendations regarding appropriate exclusion periods. No recommendations would be implemented without prior BLM approval.

Exclusion would be conducted by bat biologist(s) authorized via permit to handle Macrotus by the California Game and Fish Department. Exclusion of most bats from the Queen, and possibly other mines, would take two to three days. This would be considered in mine planning. Exclusion would consist of covering all entrances to the mine with netting after an evening outflight and before bats have started returning from foraging. As safety allows, biologists would enter the mine and assess remaining bat numbers. If numbers are considered appreciable, biologists would attempt to catch remaining bats and/or wait until the following evening and repeat the process until all or most bats are removed.

- *All historic mine adits that would be destroyed by the Oro Cruz operation would be cleared and closed, followed by the Cross, and any entrances to the Sovereign. (During the December, 1992 bat study, telemetered Macrotus were monitored exiting and entering somewhere near the Cross pit. An effort would be made to identify the location of this mine in order to exclude bats from it). All mines would be cleared of bats during a period of several consecutive evenings. The Queen mine would be cleared last, so that bats displaced from the Queen do not enter workings in other areas to be mined. Since the Queen pit is scheduled for backfilling, any underground openings uncovered in the pit wall during the course of mining would be promptly closed to prevent recolonization of the underground workings with bats.*

- *The results of Macrotus radio-telemetry studies conducted in the summers of 1992 and 1993 to identify foraging distances of males around roosts and the locations and use of alternate roost sites, would be incorporated into project planning. The primary conclusion of the studies is the need to preserve foraging habitat in the washes. Radio-transmitters would also be placed on some of the excluded Queen bats to determine where they take up residence and if they are using the gated mines (see below).*

- *Entrances of the Mesquite, King and Crown Mines would be fitted with bat gates to provide secure alternate roost sites for Macrotus and other bats displaced from the Queen and Cross Mines. Gates would be temporarily set in place and monitored during operations with night vision equipment to assess use prior to permanent installation. Ideally, counts of the bat outflight would be made at each mine before and after temporary gate installation.*

- *Gates at the King and Crown would be installed before mid-May, the start of the maternity season. If this cannot be accomplished, then the King and Crown Mines would not be gated until after September. The Mesquite Mine would be gated before this, since it is not used as a maternity roost. Gate design of the Mesquite and Crown Mines would permit desert tortoise access under at least a small section of the gate.*

- *Bat counts at mines to be secured by either a fence or gate, would be conducted by a qualified biologist to confirm continued use and to evaluate project effects. Monitoring would be conducted periodically throughout the duration of mining activities in the area and would include the "Tunnel" and Cargo Mines, which are gated and fenced.*

- *If any shafts to historic Queen underground workings remain open following Oro Cruz mining, they would be fenced or fitted with bat gates. Installed bat gates would be periodically monitored during the period of American Girl operations and closure to insure that the gates are securely in place. Repairs would be conducted as necessary. Following mining, the Cross underground would be gated to create and protect bat habitat. If practical, following Cross pit development, one or more entrances of the historic East Sovereign Mine would be reopened and eventually secured with protective bat gates to restore the roost values inadvertently lost to exploration activities.*

- *Any underground workings remaining at the Cross Mine would be protected by installing and monitoring bat gates, as specified above. These underground workings may be enhanced for bats by creating a few "bald-headed" raises at the distal end of tunnels.*

In consultation with BLM, AGMJV has recently undertaken additional measures to protect wildlife from cyanide exposure. These measures include upgrading of netting at ponds, additional net covering at pond perimeters, enclosing solution in pipes rather than in open ditches, and increased use of sonic guns to scare away wildlife. BLM would continue to monitor death from cyanide exposure and require additional mitigation measures as necessary.

Residual Effects. The proposed Oro Cruz operation would result in short-term, adverse unavoidable adverse impacts to wildlife habitat, direct mortality and displacement. While many different species would be affected, the desert tortoise and California leaf-nosed bat are species which are of most concern.

Although the proposed operational area contains no unique habitat features, wildlife inventories have found evidence of use of the site by the desert tortoise. The area does not constitute essential habitat for the desert tortoise, and site-specific inventories indicate that tortoise population density is low. The proposed action would be located outside of areas designated as critical habitat for desert tortoise by the USFWS (Federal Register, Vol. 59, No. 26). As discussed above, extensive mitigation measures would be implemented to alleviate impacts on individual

tortoises. While the proposed Oro Cruz operation would directly and indirectly lead to limited tortoise mortality, this impact would not significantly affect the tortoise population as a whole.

The destruction of the historic Golden Queen Mine would be a more significant impact to wildlife. This mine is the largest and most important maternity and winter roost in Tumco Wash and the second most important known California leaf-nosed bat roost in the Cargo Muchacho Mountains. While mitigation procedures would minimize direct mortality of the California leaf-nosed bats, destruction of this mine would result in the permanent loss of the maternity roost, and at least short-term losses of winter, summer and nightly roost habitat (less than 3 acres) that would extend for the life of the operation.

Impacts from cyanide exposure would be reduced with existing and proposed protection measures. However, wildlife could still be affected by becoming trapped in netting over solution ponds and ditches, or exposed to cyanide in ponds formed by using impact sprinklers on the existing leach pad.

Land Use

Direct and Indirect Impacts. The potential impacts of mining-related activities on the area's land uses are based upon the compatibility of the proposed operation with the existing land uses and the consistency of the proposed activities with existing management plans, policies, and regulations. The impact analysis on land use applies the following criteria to determine the significance of an impact:

- *the degree to which proposed activities would not conform with approved land management or resource management plans, existing planning objectives, zoning ordinances or other regulations on the proposed location; or*

- *the degree to which proposed activities would result in the exclusion of existing or permitted land uses on adjacent or nearby properties, either directly or indirectly.*

The proposed Oro Cruz operation would commit land to roads, waste rock disposal areas, open pits, buildings, and related facilities for the life of the operation (estimated to be 4 years). Security fences would discourage human and wildlife access to these areas. The proposed Oro Cruz operation would affect 191 acres, of which about 65 percent have been previously disturbed by historical mining and mineral exploration activities.

The proposed Oro Cruz operation and overall American Girl Project would be consistent with past, present, and future land uses. Development of Oro Cruz would continue an increase in the level of mining activity in the area that has occurred in recent years. Because the operation area which would be directly impacted has never been intensively used by recreationists, the Oro Cruz operation would not directly affect many such users. The Cargo Muchacho Mountains and other regional resources offer abundant alternative locations for the recreation that might otherwise occur within the area that would be closed to public access. The Oro Cruz operation would not have any direct impact on the destination

visitor uses at Gold Rock Ranch or at local historic sites outside the operation boundary.

The proposed Oro Cruz operation would not require changes in land ownership. Development of Oro Cruz would, therefore, have no impact on existing federal, state, or local land ownership.

The Oro Cruz operation is proposed to occur on lands administered by the BLM and would be consistent with the objectives of the BLM's Multiple-Use, Class M (moderate) classification. Multiple use includes mineral development of federal lands as long as the land can be resorted to a similar environmental setting upon closure. Reclamation would, in general, return the site to its previous use.

While an Imperial County Conditional Use Permit (CUP) is not required for Oro Cruz development, the proposed operation would also be consistent with County plans and policies. Imperial County has previously issued CUPs for the Padre Madre and American Girl Canyon operations, indicating consistency and compliance with the existing Imperial County Land Use Plan and applicable Elements of the County General Plan. The proposed Oro Cruz operation would also be in compliance with recent revisions to County Plans.

Overall, land use impacts of Oro Cruz development would constitute a low adverse impact. The mining land use would be temporary in nature in an area already disturbed by previous mining activities. Reclamation and closure activities would allow for a post-mining land use of wildlife habitat/open space. The proposed operation would be consistent with BLM and County land management plans and affect few other land users.

Impact Mitigation. The applicant has proposed environmental protection measures such as reclamation, closure and security activities (see Chapter 2) to reduce potential adverse effects. No additional mitigation measures would be required.

Residual Effects. The proposed operation is consistent with BLM land use designations. However, Oro Cruz implementation would limit most future non-mining uses of the mining area, such as recreation. This preemption of future recreational uses would be partially mitigated by the availability of other nearby similar recreational resources. After reclamation and closure activities, the operational area would be generally consistent with wildlife habitat/open space land uses.

The proposed Oro Cruz operation is also consistent with Imperial County land planning objectives relative to mineral extraction. However, it would not be feasible to return the operational area to a "natural condition" at the completion of operations. Although buildings and some structures would be removed at the end of the anticipated 4-year life of the operation, the mine pits, waste rock dump and heap leach would remain to permanently alter the physical character of the area.

Recreation

Direct and Indirect Impacts. On both a regional and local basis, there is an abundance of recreational opportunities involving exploration of historic resources, sightseeing, off-road vehicle use, camping,

and rockhounding. Recreational resources could be affected through three primary mechanisms:

- *direct disturbance of the recreational resource,*
- *changes in access to the recreational resource, and*
- *changes in the numbers and/or types of users of the recreational resource.*

Because of the limited nature and scope of the proposed operation and expectation for no additional population associated with development, the effect on regional recreation resources would be low. Regional recreational users would still have full access to recreation opportunities involving the Salton Sea, Imperial Sand Dunes, the Colorado River, Long-Term Visitor Areas, and other uses of public lands managed by BLM.

On a more localized basis, Oro Cruz development is likely to alter the access to and remove some land from potential recreational opportunities. The vast majority of recreational users in the Oro Cruz area are considered short-term pleasure visitors. These visitors are primarily interested in the cultural, geological, and scenic resources of the Oro Cruz area. The proposed Oro Cruz operation would restrict access to areas within and directly surrounding the mining development through fencing and other security measures. Current users of these lands would no longer have access for future uses of these lands if Oro Cruz is developed. However, there are relatively abundant nearby lands which could be used as substitutes for the geological and scenic resources within the Oro Cruz area.

The proposed location of the fences restricting public access to Oro Cruz operations would still allow access to the cultural resources within the Tumco/Hedges historic townsite. Visitors to the historic townsite would have a direct view of Oro Cruz operations, which might add to their interest in gold mining from both a historical and current-day perspective. Therefore, an indirect effect of Oro Cruz development would be increased visitation to the Tumco/Hedges townsite.

Impact Mitigation. The proposed Oro Cruz operation would not significantly affect recreational opportunities or quality of experience. To mitigate the anticipated indirect effect of increased visitation to Tumco/Hedges, BLM would require AGMJV to develop and maintain a pedestrian interpretive trail with appropriate literature and signage documenting historic and current mining activities.

Residual Effects. Residual effects would be minimal and not significant.

Visual Resources

Any project that introduces new or changed forms, lines, colors, and textures to a landscape would have an impact on the visual character of the area. A number of factors must be considered in the evaluation of visual impacts. Primary among these factors is the issue of how visible the changes are from viewpoints most likely to be used by people. A number of subjective and objective factors must be considered in a visual impact analysis. Among these factors is the number of viewers to be affected, as

well as viewer sensitivity, distance and atmospheric conditions of viewing, existing and historic land uses, and scenic quality of directly impacted and adjacent areas.

Chapter 3 provides a description of the visual resource existing environment in VRM terminology. Key observation points (KOPs) have been chosen to represent views of the proposed Oro Cruz area and of the existing Padre Madre and American Girl Canyon operations. KOP-1 presents a direct view of Oro Cruz operations from Ogilby Road; KOP-2 presents a direct view of American Girl Canyon operations from Ogilby Road; and KOP-3 presents a distant view of the project from the intersection of Interstate 8 and Ogilby Road.

Table 36 summarizes the contrast effects of the proposed Oro Cruz operation on the views from the three KOPs. As shown in the matrix, the visual contrast of the proposed alternative with the existing landscape ranges from a "no contrast" rating to a "moderate contrast" rating, depending on a viewer location, distance from the site, and time of day (daylight or darkness). This evaluation was performed by using the standard BLM Visual Contrast Rating worksheets (Appendix B). The visual contrast ratings shown in the matrix are based on the final contours (maximum heights) of the various project components that are either currently visible, or would be visible with approval of the Oro Cruz operation.

Types of Impacts. In general, the three primary visual impacts of the proposed operation are 1) operation illumination during nighttime hours, 2) fugitive dust generation, causing a "dust plume" that contrasts with the surrounding clear air and increases project visibility, and 3) introduction of new landforms. Oro Cruz operational plans incorporate certain elements that serve to reduce these impacts. These include 1) the use of hooded halide light plants that direct light downward and reduce visibility of the mine at night, 2) the use of water and/or chemical surfactants for dust suppression, and 3) backfilling of the Queen pit to lessen the visual effect of the pit and to produce a smaller waste rock disposal area.

TABLE 36

VISUAL CONTRAST FROM ORO CRUZ

Key Observation Point	Operational Phase		Post-Operational Phase	
	Daytime	Nighttime	Daytime	Nighttime
KOP-1, Ogilby Rd. at Gold Rock Ranch Rd.	M	L	M	O
KOP-2, Ogilby Rd. near American Girl Canyon	M	L	M	O
KOP-3, Ogilby Rd. at Interstate 8	O	O	O	O

O- No contrast
L- Low contrast
M- Moderate contrast

In addition to these operational factors, post-mining reclamation would reduce the ultimate visual impacts of the proposed operation. Slope contours would be graded to blend into the surrounding topography, flat waste rock disposal area benches would be ripped in accessible areas, a top-dressing of suitably textured material would be applied, and natural drainages would be reestablished. These aspects of reclamation also have been taken into account in the visual impact assessment.

Eventually the color contrasts of the visible mine elements would weaken slightly, as waste rock weathers and darkens to a hue closer to that of the surrounding terrain. The weathering process is very slow in the desert, however, so color contrast may remain for many years. Erosion would soften the geometric shape of the elements, reducing contrasts in form and line. The partial establishment of vegetation on waste rock disposal area(s) and leach pads would create a texture similar to that of the desert floor.

Information on the Oro Cruz visual impacts from KOP-1 and KOP-2 are presented in the next section. These two KOPs represent the most direct views of Oro Cruz mining and waste rock disposal (KOP-1) and heap leach processing at American Girl Canyon (KOP-2). Visual impacts from KOP-3 do not directly include any Oro Cruz facilities or components, but rather shows the overall American Girl Project site (primarily the Padre Madre operation) from Interstate 8, the most heavily travelled major road in the vicinity. KOP-3 is included primarily because of its importance in describing cumulative impacts, and is therefore discussed in the Cumulative Impact section.

KOP-1 - Intersection of Gold Rock Ranch Road and Ogilby Road. The intersection of Gold Rock Ranch Road and Ogilby Road marks the access point to Gold Rock Ranch (travelling west from Ogilby Road) and is the main access route to the historic Hedges/Tumco townsite (travelling east from Ogilby Road). The proposed Oro Cruz operation would be directly visible from KOP-1.

Mining operations at Oro Cruz would consist of two shifts and extend into nighttime hours. Night lighting of the mining operations may attract the attention of the casual observer on Ogilby Road because of the glow the mine lights would create. As mining progresses, lighting would become more noticeable as the waste rock disposal areas rise. The use of hooded light fixtures to direct the light downward would reduce this impact. Although night lighting would contrast moderately with the surrounding desert darkness, the overall visual impact is considered to be low because of the low traffic volumes at night on Ogilby Road.

The visual impact from airborne particulates at the mining sites would be minimal with periodic magnesium chloride and water spraying of mine roads, ore pits and rock waste rock dumps. In general, particulates would be confined to the mining area, although wind conditions could increase airborne particulates, thereby increasing the corresponding adverse visual effect (see the Air Quality section).

The operational components which would be most visible from KOP-1 include the Cross and Queen pit highwalls and the main waste rock dump. A

simulated version of maximum visual impacts of these facilities is included in Appendix C (Figure C-1). The angular form of the waste rock dump site would weakly contrast with the massive irregular backdrop of the mountain range. The dominant horizontal line of mine elements would moderately contrast with the vertical line of the surrounding mountains. Color contrasts would be strongest. The light reflective hues of waste rock and mined-out pits would moderately contrast with the dark hues of the mountainside.

Long-term visual impacts from the proposed operation would not be considered significant. The area is largely uninhabited and would likely remain so for many years. At the mine site, the Queen pit would be backfilled and the waste rock dump would be recontoured at the conclusion of operations. Natural revegetation and erosive actions, supplemented by the proposed revegetation and transplantation program, would eventually result in the appearance of the mining terrain similar to the historically-disturbed surrounding hills. Existing and future visual contrast observed from KOP-1 would not exceed CDCA Plan Class M visual objectives for the operational landscape.

Visitors to the Hedges/Tumco historic townsite would have a direct view of Oro Cruz facilities and operations. The effects upon these visitors would depend upon individual values. Generally, visitors to the Hedges/Tumco area are aware of the mining history of the region, and many would believe a view of current mining operations to be an interesting, positive feature. Others may believe the Oro Cruz operation to be a visual intrusion to the historic townsite. Visitors at the Gold Rock Ranch settlement would not see the operations because of the screening afforded by the topography and desert vegetation.

KOP-2 - View from Ogilby Road of American Girl Canyon Operations. . KOP-2 is the point on Ogilby Road from which existing American Girl Canyon facilities are most visible. Ogilby Road in the vicinity of this KOP is a two-lane road, primarily straight with good visibility. South from Gold Rock Ranch Road, the American Girl Canyon heap leach pad and waste rock disposal areas are intermittently visible to the casual observer over about a 3-mile segment of the road. Traffic travels at or above 55 mph. Each of the intermittent views of the site lasts approximately 0.5 second at this speed.

Post-operational and pre-revegetation areas visible from KOP-2 are the waste rock disposal area and the heap leach pad. A simulated version of the maximum visual effect of these facilities from KOP-2 is included in Appendix C (Figure C-2). These project elements consist of simple geometric forms with consistent shapes. The man-made elements have horizontal tops and angular, moderately steep, relatively smooth side slopes. The form of these elements contrasts moderately with the predominantly rugged, irregular form of the surrounding Cargo Muchacho range. Color contrasts are moderate due to the light, reflective hue of the mined ore, which is similar to the color of the desert floor and contrasts with the dark garnet colors of the mountains.

The textural contrast between the indigenous landscape and the post-operational fill material is weak. The smooth, uniform surfaces of the mine facilities contrast somewhat with the coarse, irregular

texture of the surrounding hillsides, but the effect of this contrast diminishes rapidly with distance.

The daytime contrast at this KOP is considered moderate. However, the overall adverse visual impact observable from KOP-2 would be low because of the modifying influence of the distance between viewer and site.

Nighttime activities at American Girl Canyon consist only of mill operations and security lighting. There is no direct view of these lighted activities. Nighttime contrast is low from this KOP.

Existing and future visual contrast observed from KOP-2 would not exceed CDCA Plan Class M visual objectives for the project landscape.

Impact Mitigation. The applicant has proposed environmental protection measures in its Reclamation and Closure Plans (see Chapter 2) to reduce potential adverse effects. In addition, all visible facilities would be painted a desert tan or other color acceptable to BLM.

Residual Effects. The facilities associated with the proposed Oro Cruz operation would cause a noticeable visual effect which would become greater over the anticipated 4-year operations period. Because the proposed operation would be located adjacent to the American Girl Canyon operations and other historic mining disturbances, this visual effect would be less than that of the same operation in a previously undisturbed area. Nonetheless, the visual changes caused by the operation would be permanent. Reclamation efforts would only partially lessen the unavoidable adverse impacts to the existing visual resources.

Sound

Direct Impacts. The primary sources of project-related noise would be the heavy construction vehicles, mining and crushing equipment, and blasting. Sound levels of common sources on a mine are presented in Table 37. These are the typical sound levels at close distances. Off-site levels of sound from mining activities would be less than on-site sound levels due to three physical phenomena. First, as sound travels away from the source, it decreases in energy simply by divergence as the sphere over which the sound energy is spread increases in size. By divergence, the sound energy decreases by the square of the distance from the source receptor. In other words, when the distance between source and receptor doubles, the sound energy decreases to one quarter. Second, natural land barriers act as absorbers of sound, and sound energy decreases substantially behind a natural barrier. Third, sound is attenuated by the air through which it travels, the high frequencies at a greater rate than the low frequencies.

Considering the divergence and atmospheric attenuation only, a 90 dB(A) sound level (haul truck) at 50 feet becomes about a 26 dB(A) sound level at 3 miles, the distance of the nearest resident. This is well below the normally acceptable noise levels for locations listed in Table 25 of Chapter 3.

Blasting may or may not be heard at 3 miles depending on the weather and temperature inversions, effect of the natural barriers around the project, and

TABLE 37

ESTIMATED SOUND LEVELS GENERATED BY MINE EQUIPMENT

Source	Sound Pressure Level dB(A)
Blasting	170 @ 91 m (300 ft)
Bulldozers	87 @ 15 m (50 ft)
Front-end loaders	90 @ 15 m (50 ft)
Haul trucks	90 @ 15 m (50 ft)
Primary/Secondary Crushers	95 @ 15 m (50 ft)
Utility Vehicles	90 @ 15 m (50 ft)
Conveyor	78 @ 10 m (33 ft)

* The sound pressure level in decibels (Db) corresponding to a sound pressure (P) is compared to a reference level of 20 micropascals. Sound pressures for various frequencies of noise are weighted by factors (A weights) which account for the response of the human ear. The sound pressure level is dB(A) = 20 Log10 (P/20).

Source: EPA, 1988.

intensity of each particular blast. If a blast is heard, it would be heard only during daytime hours, and would be heard only as a low-frequency rumbling which is not generally an obtrusive sound. Sound impacts from the Oro Cruz operations would be negligible.

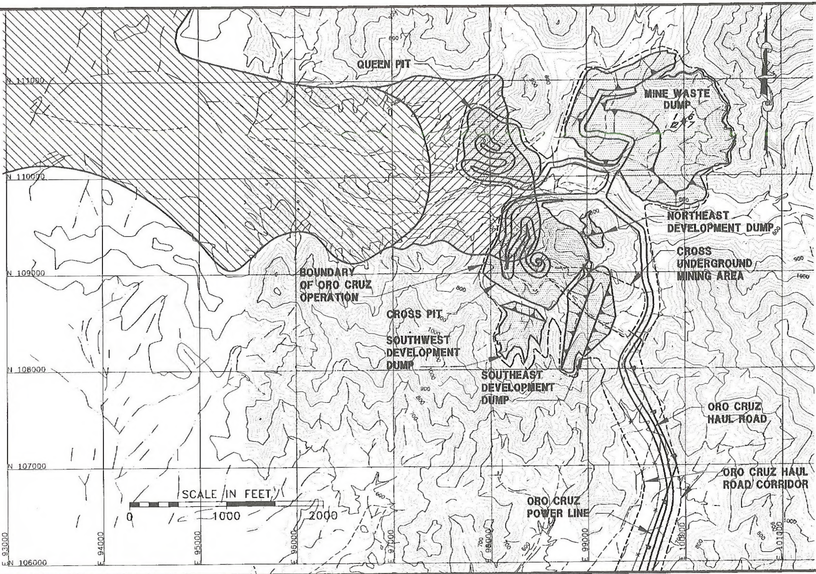
Impact Mitigation. The applicant has proposed environmental protection measures (see Chapter 2) to reduce potential adverse effects. No additional mitigation measures would be required.

Residual Effects. Residual adverse effects would be negligible.

Cultural Resources

Evaluation of all potential impacts to cultural resources within the Area of Potential Effect (APE) is required pursuant to Section 106 of the National Historic Preservation Act (as amended) and its implementing regulations (36 CFR Part 800), Section 101 (b)(4) of NEPA, the Archaeological Resources Protection Act (ARPA), and the Joint Resolution on American Indian Religious Freedom Act. Specific procedures must be followed to document compliance with Section 106 and ARPA as discussed below.

Direct and Indirect Impacts. As shown in Figure 41, the proposed area of Oro Cruz disturbance is at the extreme eastward end of the NRHP-eligible Hedges/Tumco Historic Townsite. Adverse impacts



HEDGES/TUMCO HISTORIC RESIDENTIAL/COMMERCIAL/INDUSTRIAL COMPLEX

HEDGES/TUMCO HISTORIC MINE COMPLEX

FIGURE 41

HISTORIC CULTURAL RESOURCE AREA NEAR PROPOSED ORO CRUZ FACILITIES

to the historic archaeology within the mining complex (i.e., glory holes, hoist house locations, tailings, adits, and underground workings associated with the Golden Queen and Golden Cross Mines) would occur in the area proposed for Oro Cruz mining. These historic mine workings do not significantly contribute to the eligibility of the townsite for NRHP listing.

The cultural resources inventory of the proposed Oro Cruz haul road yielded 3 historic sites, 12 historic isolated finds, and 3 Native American isolated finds. The 3 historic sites are traces of the wagon road (including supportive side-wall rock at the upper end of the road) providing a vehicular transportation route between American Girl Canyon and Tumco Wash; a partial rock structure with sparse refuse, a water tank, and several open pit prospects; and a trail providing a pedestrian route between American Girl Canyon and Tumco Wash. The 15 isolated finds yielded 28 artifacts including 3 aboriginal ceramic pots, a horseshoe, 2 cans, and 22 bottles. These surface manifestations are not eligible for the NRHP. No subsurface sites along the haul road route have been identified. The potential for the existence of prehistoric or historic subsurface cultural resources in the haul road area is limited because there is little or no soil depth to cover cultural resources. No prehistoric or historic cultural resources were recorded during the inventory of the proposed waste dump site. An indirect effect of Oro Cruz development would be increased visitation to the Tumco/Hedges townsite area (see Recreation section).

Beyond the identification of potential impacts from Oro Cruz development within the scope of this EIS, additional procedures must be followed to identify and mitigate impacts to cultural resources. The following steps have been undertaken with respect to both the Section 106 and ARPA review processes:

- *All areas of proposed impact received a cultural resource inventory. Cultural resources located with these areas are being evaluated under the criteria set forth in 36 CFR 60.4 for eligibility to the National Register of Historic Places (NHRP). A Determination of Eligibility is being made by BLM in consultation with the California State Historic Preservation Office (SHPO).*

- *The BLM is applying the Criteria of Effect to those cultural resources which are eligible for NRHP listing. The BLM would seek SHPO concurrence on this Determination of Effect and would consult with the SHPO to determine appropriate mitigation measures.*

Impact Mitigation. The proposed Oro Cruz operation concept has been designed by AGMJV to avoid major conflict with cultural resources. Any necessary mitigation requirements would be identified by BLM and SHPO, in the process described above. In addition, a pedestrian interpretive trail would be developed and maintained by AGMJV to mitigate the anticipated indirect effect of increased visitation to the Tumco/Hedges area. The trail would provide for appropriate literature and signage to interpret historic and current mining activities.

Residual Effects. The proposed action would result in the destruction of the historic Golden Cross and Golden Queen open pits and the existing underground mine workings. A portion of these resources have been recorded in some detail through on-the-ground and aerial photography, mapping and illustration. Although additional mitigation of these resources may be developed in consultation with the SHPO, the underground workings are too unstable and dangerous for extensive recording. Cultural resources found in the proposed haul road corridor can be avoided or adequately mitigated. Residual unavoidable adverse impacts to cultural resources would not be significant.

Transportation

Direct and Indirect Impacts. The system of roads and highways in the vicinity of the American Girl Project could experience some very slight increases in traffic volume as a direct result of the implementation of the proposed Oro Cruz operation. However, because the increase in Oro Cruz operations work force compared to the existing project is expected to be only 18 persons, the effect would be a low adverse impact.

Existing traffic patterns directly and indirectly associated with the project would remain essentially the same with Oro Cruz development. The vast majority of operation- related traffic would continue to use the Interstate 8/Ogilby Road/American Girl Mine Road project access route. With Oro Cruz development, traffic levels and patterns associated with the American Girl Project would be in existence two years longer than currently approved project activities at Padre Madre and American Girl Canyon.

Impact Mitigation. There are no identifiable adverse effects which would require mitigation.

Residual Effects. Residual adverse effects would be negligible.

Socioeconomics

Primary factors affecting the timing and magnitude of socioeconomic impacts include:

- *personnel needs (number and schedule)*
- *the existence of an available workforce; and*
- *the need for additional workers (and their dependents) to migrate into the area.*

Therefore, employment is the driving factor affecting socioeconomic impacts.

Employment and Income. AGMJV has prepared employment estimates for the Oro Cruz operation. Table 38 shows the historic and projected schedule of personnel needs for the American Girl Project with and without Oro Cruz development. Analysis of the future personnel needs associated with the Oro Cruz operation yields several important conclusions:

- *all employees are considered "operating" employees; there is no scheduled "construction" employment because the operation would use existing equipment operators and laborers for the minimal construction activities associated with haul road, open pit, and waste rock development;*

- *the projected shift from use of existing personnel at Padre Madre and American Girl Canyon to Oro Cruz operations would be relatively smooth; and*

- *the 156 current AGMJV employees would be supplemented with an additional 18 workers at Oro Cruz in 1994.*

Oro Cruz development would therefore allow the continued employment of the 156 current employees beyond the shutdown of Padre Madre and American Girl Canyon operations, plus it would provide an additional 18 jobs beyond current conditions through 1995. With the large existing employment base in the project area, the 18 additional jobs could be filled by existing residents of Yuma or Imperial Counties. No immigration of new persons or their families into the 2-county area would be expected as a result of Oro Cruz development. The peak annual operating payroll associated with Oro Cruz would be over $5.5 million for the 174 workers in current dollars.

The direct permanent employment associated with Oro Cruz would indirectly continue the generation of

TABLE 38

HISTORICAL AND PROJECTED ANNUAL (Year End) EMPLOYMENT
With and Without Oro Cruz

Year	Historical	With Oro Cruz Component	Without Oro Cruz Component
1986	14	--	--
1997	44	--	--
1994	68	--	--
1986	105	--	--
1986	163	--	--
1994	164	--	--
1992	105	--	--
1993	156	--	--
1994	--	174	131
1995	--	174	0
1996	--	120	0
1997	--	5	0
1998	--	0	0

other year-round secondary jobs in the 2-county area, principally in trade and service occupations. Assuming .5 indirect jobs for every direct mining job at Oro Cruz, an estimated 87 additional jobs in the region would be supported by Oro Cruz through 1995. Although this direct and indirect employment would be a relatively minor source of employment and income in an area heavily oriented toward agriculture and tourism, it would contribute to the moderation of local seasonal fluctuations in the 2-county area.

Population. The proposed development and operation of Oro Cruz would not appreciably affect the population of Yuma and Imperial Counties. These counties have a combined year-round population of over 215,000 persons; this number is growing at a relatively rapid pace for reasons unrelated to any mining in the area. Planned AGMJV employment increases associated with Oro Cruz development would be minimal, and existing employees at Padre Madre and American Girl Canyon would comprise the vast majority of Oro Cruz workers. The additional 18 jobs projected for Oro Cruz operations would likely be filled by existing residents of Yuma or Imperial Counties. Therefore, there would not be any identifiable direct demand for new workers at Oro Cruz who would add to the existing population.

Housing. Operations employment is not expected to have any identifiable impact on the local housing supply. About 84 percent of the Oro Cruz operations work force would be existing AGMJV employees at Padre Madre or American Girl Canyon. The small number of additional workers associated with Oro Cruz would be recruited locally. Therefore, the proposed operation would not lead to any change in the supply or demand for housing units.

Public Services and Utilities. The proposed Oro Cruz operation would have minimal impact on local community services and infrastructure. The American Girl Project already has on-site fire-fighting equipment, water supply, wastewater collection and disposal facilities, and security personnel, thus eliminating the need for local public agencies to serve the project site under normal construction and operating circumstances. Local services to the site would be limited to a backup role in case of emergency.

AGMJV personnel and their families who live in the 2-county area, as well as people who fill any indirect jobs associated with the operation, would have an impact on the demand for services and utilities. However, the number of such people would be so small relative to the overall existing population that services and utilities would not be noticeably affected. Therefore, the proposed Oro Cruz operation would not create an identifiable impact on public services and utilities.

Impact Mitigation. There are no identifiable adverse effects which would require mitigation.

Residual Effects. Residual adverse effects would be negligible.

Potential Hazards from Use of Cyanide in Ore Processing

Cyanide has been used in various processing methods to extract metals from ore for over 100

years. The technology of using cyanide as part of a heap leach process was refined in the 1970s. Commercial applications of the technology have rapidly grown because it is one of the only economically feasible methods to extract gold and silver from low-grade ore deposits.

Sodium cyanide is a hazardous substance which is toxic to human and wildlife. Because of its toxicity, there are many concerns related to its use, including:

- *the extreme toxicity of cyanide;*
- *the hazardous effects to employees during handling and use;*
- *the possibility of a spill during transportation or storage on the mine site;*
- *wildlife deaths, particularly of migratory birds, by drinking cyanide process solutions from open ponds;*
- *spills that could contact ground or surface water, affecting human drinking water or fish and wildlife;*
- *the adequacy and enforcement of existing laws and regulations governing mining operations that use cyanide.*

Sodium cyanide has a fairly complex chemistry. In heap leach and milling operations, the cyanide solution must be maintained under carefully controlled conditions. Otherwise, the solution begins to decompose, making the solution both less useful for extracting gold and less hazardous.

While cyanide is lethal in large single (acute) doses, it does not accumulate in the body as a result of a number of small exposures over time (it has a low chronic toxicity). When cyanide is ingested, highly toxic hydrocyanic acid can form and react with iron in the blood to destroy the blood's ability to carry oxygen to the body. If the dose is strong enough, death could result. If not, the kidneys purge cyanide from the blood and the body recovers.

Although employees at both milling and heap leach facilities work in close proximity to the process solutions, there are no known cases of accident or severe illness directly due to cyanide exposure. This is due to several factors. Cyanide in the process solutions would be of a dilute concentration (less than 500 ppm). Operating conditions are tightly controlled to prevent the formation of HCN.

Additionally, cyanide breaks down quickly into harmless substances when exposed to ultraviolet light and to various components frequently found in soil, such as minerals and microorganisms. Similarly, precipitation or other contact with water can quickly dilute cyanide solutions to non-lethal levels.

Cyanide processing is a well-understood and controlled operation. No impacts to human health and welfare would be expected with the proposed Oro Cruz operation. Impacts to wildlife from exposure to cyanide are discussed in the wildlife section of this Chapter.

Impact Mitigation. The applicant has incorporated measures into its proposed plans such as monitoring of cyanide concentrations to control any possible effects from cyanide exposure. No additional mitigation measures would be required. Mitigation measures to reduce the effects of cyanide on wildlife are discussed in the wildlife section of this Chapter.

Residual Effects. Residual effects to public and employee health and safety would be negligible.

Residual effects to wildlife from cyanide exposure are discussed in the Wildlife section of this Chapter.

Reclamation Costs

The total estimated cost for recontouring, providing final drainage and for revegetating the American Girl Project is shown on Table 39. The cost estimate is further broken out in the table for each of the three operations that comprise the American Girl Project. The cost estimate is based on the presumption that third party contractor(s) would be retained by the regulatory authorities to complete the reclamation tasks. A reclamation bond would be provided by the applicant to guarantee reclamation performance. The bond would be made payable to BLM, Imperial County, and the California Division of Mines and Geology as co-payees.

Estimated costs to guarantee site closure are provided in the Closure and Post-Closure Plan prepared by AGMJV. The closure costs estimates are based on the following elements:

TABLE 39

RECLAMATION COST ESTIMATE SUMMARY

	American Girl Canyon	Padre Madre	Oro Cruz	TOTALS
Spent Ore Heap Recontouring	$ 77,100			$ 77,100
Waste Rock Dump Recontouring	$ 6,700	$ 1,608	$ 1,310	$ 9,618
Open-Pit Recontouring	$ 11,365	$ 9,060	$ 6,595	$ 27,020
Road Recontouring	$ 12,730	$ 33,320	$ 32,645	$ 78,695
Facility Recontouring	$ 7,680			$ 7,680
Power Line & Fence Removal	$ 11,144	$ 13,294	$13,278	$ 37,716
Underground Mine Access Sealing	$ 29,440		$ 16,720	$ 46,160
Gravel Pit Grading & Drainage Reestablishment	$ 18,160		$ 14,640	$ 32,800
Revegetation	$115,540	$ 72,242	$ 60,884	$248,666
Subtotals	$289,859	$129,524	$146,072	$565,455
Contractor Overhead (5%)	$14,493	$6,476	$7,304	$ 28,273
Contractor Profit (10%)	$28,986	$12,952	$14,607	$ 56,545
Subtotals	$333,338	$148,952	$167,983	$650,273
Agency Supervision (15%)	$50,001	$22,343	$25,197	$97,541
TOTALS	$383,339	$171,295	$193,180	$747,814

- *reducing free cyanide levels in the heap to acceptable levels by rinsing with recirculation water;*
- *drilling and sampling the heap, with leach testing and analysis to check for acceptable free cyanide levels;*
- *regrading the side slopes of the heap for acceptable long-term stability;*
- *removing and disposing sludges collected in the pregnant and barren solution ponds;*
- *decommissioning the pregnant and barren solution ponds;*
- *removal and salvage of all equipment and buildings;*
- *site maintenance and monitoring;*
- *lead agency field supervision;*
- *lead agency administration overhead;*
- *contractor bond; and*
- *contractor profit.*

Costs for these elements are shown in Table 40.

TABLE 40

AMERICAN GIRL PROJECT CLOSURE ESTIMATE

Task/Description	Subtotal
Spent Ore Heap Detoxification Process Plant Closure	1,092,570 5,230
SUBTOTAL	**$1,097,800**
Long-term Maintenance and Monitoring	$40,000
Lead agency field supervision Lead agency admin. overhead (5%) Contractor bond (2%) Contractor profit (10%)	61,560 64,056 25,623 128,113
SUBTOTAL	**$319,352**
TOTAL	**$1,417,152**

Therefore, the required bond amount to ensure closure is estimated to be $1,417,152. A bond in this amount would be posted by the applicant, with the Regional Water Quality Control Board and BLM listed as co-payees.

Impact Mitigation. A Reclamation Plan and Closure and Post-Closure Plan have been prepared to identify specific proposed reclamation and closure needs and techniques. Costs must be expended to carry out the Plans, which are important parts of the environmental protection effort proposed by the applicant. Bonds would be posted by the applicant to ensure that reclamation would be carried out under any circumstances.

Residual Effects. All impacts cannot be fully mitigated through implementation of the proposed Reclamation Plan and Closure and Post-Closure Plan. Residual impacts are discussed in other sections of this Chapter of the EIS. The expenditure of funds for reclamation and closure would substantially mitigate potential impacts, thereby reducing residual effects in most elements of the human environment.

ALTERNATIVE 1 -- NO ACTION ALTERNATIVE

Implementation of the Oro Cruz operation as proposed by AGMJV would result in a variety of environmental impacts (as described above). Alternative 1, the No Action alternative, would eliminate those impacts which the proposed operation would generate. A summary of the effects associated with the No Action alternative is presented below. BLM can implement the No Action alternative only

if the proposed operation (with mitigation) would result in unnecessary or undue degradation of Federal lands.

Climate and Air Quality

Under this alternative, the air quality would remain essentially the same as it is now. Concentrations of all regulated pollutants would remain at their present levels; there would be no additional emissions affecting air quality.

Geology

If the No Action alternative were to be implemented, the ore body would remain in the ground. Exploration on and around the site would probably continue. Interest in the mineral resource would likely continue and plans for a similar operation could be submitted in the future. Existing topography would not be modified by the development of open pits and waste rock dumps unless an operation was approved at some future time.

Hydrology

There would be no potential for impacts to water resources due to mining operations under the No Action alternative. The diversion of surface drainages would not be required. The groundwater that would be pumped and used for the proposed operation would not be used and, therefore would be available for other uses.

Soils

Selection of the No Action alternative would mean the site would remain in its present condition. The impacts to soil resources as a result of the proposed action would not occur. The present erosion and sediment rates would continue. These rates are elevated over natural conditions due to the present disturbance on site.

Vegetation

If the No Action alternative is implemented, no vegetative cover would be disturbed and the proposed operation site would remain in its present condition. The proposed reclamation of the disturbed area would not be necessary.

Wildlife

Selection of the No Action alternative would leave the operation site in its present condition. Wildlife habitat would remain as it is, and no additional impacts to wildlife would occur. AGMJV would be required to reclaim its exploration activities, and the Sovereign Mine would be reopened by AGMJV for use by bats under this alternative.

Land Use

The No Action alternative would not impact the existing land uses of open space and wildlife habitat. Current land uses are compatible with BLM and County management plans; therefore, reclassification of land use would not be necessary.

Recreation

The potential impacts associated with the proposed action would not occur under the No Action alternative. The Tumco/Hedges historic townsite would continue as an recreational attraction near

existing American Girl Project facilities. Other recreational opportunities would continue to exist throughout the region surrounding the proposed operational area.

Visual Resources

The No Action alternative would leave the site as it presently exists and the operation facilities would not be developed. No additional visual impacts would occur. The visual impacts caused by existing scars from historic mining disturbances, roads, adits, and drill sites would remain present at the site.

Sound

Increased noise in the vicinity of the mine site would not occur if the proposed operation was not implemented.

Cultural Resources

The No Action alternative would eliminate any impact to properties associated with the historic Hedges/Tumco era mining activities. Deterioration of historic foundations and other cultural resources would continue from exposure to weather and other natural elements. Alteration or destruction of prehistoric sites could occur from continued exploration, and by recreationalists and tourists.

Transportation

The No Action alternative would not alter existing conditions associated with highways and roads.

Socioeconomics

The No Action alternative would postpone or eliminate the impacts associated with additional employment, income, and local government revenues stemming from the proposed action. The beneficial aspects of the project, jobs and increased revenues would not be realized if the No Action Alternative were selected.

ALTERNATIVE 2 -- COMPLETE BACKFILLING OF ORO CRUZ WASTE ROCK

AGMJV has proposed a partial backfilling scenario in which the Queen pit would be backfilled. This alternative analyzes complete backfilling of Oro Cruz waste rock. Other portions of the Oro Cruz operation remain the same as those proposed by AGMJV under this alternative.

Mineral Resources and Operational Effects

Gold deposits such as those in the American Girl Project area have boundaries which are defined by mineralized material which can be mined at a reasonable return on investment (known as ore) and mineralized material which cannot be mined economically under existing conditions. This demarcation is effected by geologic, operational, and economic criteria and is predictable within the limits of reasonable geologic interpretations of exploration drilling and current economics. However, it is likely to change as mining progresses and new information

is collected from ongoing geologic studies of the deposit. Changing metal prices, mining and processing costs, as well as new advances in mining and processing technology would also dictate adjustments in the boundary between economic and non-economic mineralization during the life of the operation.

Backfilling Process. The open pit approach used in precious metals mining is to follow a geologic structure to great depth in an attempt to recover the ore. This often precludes any actual backfilling of the pit until the deposit is completely mined out. The mining sequence at some open pit operations would allow one pit to be completely mined prior to opening a second pit. Backfilling of the first pit would be a planned part of the mining process, a situation known as sequential backfilling. Sequential backfilling of the Queen pit is proposed by AGMJV for Oro Cruz operations. The Queen pit would be totally mined out, with Queen and Cross pit waste rock used for backfill into the Queen. Backfilling of the Cross pit under this alternative could not commence until after completion of all mining.

Complete backfilling would involve loading and hauling 4.4 million tons of waste rock from the Oro Cruz waste dump to the Cross pit (a distance of 0.4 miles) with the remaining 3.0 million tons hauled to American Girl Canyon for disposal (2.9 miles). Major equipment for the project would be from AGMJV's existing fleet and would include:

- *CAT 992 loader (2)*
- *50 ton haul trucks (7)*
- *Motor grader*
- *Water truck*
- *Lube truck*

Based on the known haulage cycle times and a one-shift - five days/week schedule, production rates would be 10,000 tons/day for the Cross pit backfilling component and 8,600 tons/day for the American Girl Canyon backfilling.

Future Mining Potential. Open pit deposits are mined as roughly conical pits which are developed by advancing the pit walls and bottom incremental to the limits of the ore material. The final pit walls would contain mineralized material which cannot be economically recovered at the time of mine closure. These lower grade zones may be mined profitably at a future date under improved economic conditions (e.g., higher precious metal prices, or with the development of new mining or mineral processing technologies).

Backfilling the pit would bury these low-grade zones, thereby making future mining of these potential reserves much more difficult and expensive. The additional costs required to re-excavate the waste rock to reach the ore could prevent future mining and preclude the significant economic benefits to society derived from the natural resource development.

Geology and Topography. Due to the severe topography in the Cross pit, the 250 foot highwall remaining after mining would be reduced to a 125 foot highwall after Cross pit backfilling. Therefore, the pre-mining topography would not be recreated. The unmineralized material placed back in the pit during backfilling could obscure information critical to the geologists' search for additional ore in the Oro Cruz gold deposit, resulting in a long-term adverse impact.

Project Economics. The most costly part of most mining projects is the materials handling costs associated with moving the millions of tons of ore and waste rock. In a recent memorandum to the California State Director of the BLM, the U.S. Bureau of Mines states:

> "The single most significant aspect of backfilling open pits is costs. For typical open pit operations, loading and hauling material is the largest mining costs component (excluding mineral processing). Backfilling essentially doubles the cost of loading and hauling. This could make an otherwise profitable mine uneconomic to develop and operate."

Due to the relatively small size of the Oro Cruz operation, a decision to backfill pits would have a significant impact on project economics and the overall viability of the project. This is particularly true since the Cross pit backfilling would not be possible as part of the mining sequence, but would have to be conducted as a separate operation following the completion of mining.

The Cross pit would not accommodate all of the accumulated Oro Cruz waste. Therefore, in order to accomplish complete backfilling, waste would have to be hauled to American Girl Canyon pits in addition to the Oro Cruz Cross pit. Costs associated with the complete backfilling scenario are estimated below:

CROSS PIT COMPONENT

Unit Costs:

Loader	0.18/ton
Haulage	0.27
Dozer	0.04
Road Maintenance	0.08
Total cost	**0.57**

At a production rate of 10,000 tons/day, placing the 4.4 million tons of waste rock in the Cross pit would take 440 working days, or 1.76 years. Total estimated backfilling costs would be:

Production costs	
(4,400,000 tons x 0.57/ton)	$2,508,000
Overhead costs	
(1.76 years x $520,000/year)	915,000

TOTAL COST - CROSS PIT BACKFILLING $3,423,000

AMERICAN GIRL CANYON PIT COMPONENT

Unit Costs:

Loader	0.18/ton
Haulage	0.58
Dozer	0.04
Road Maintenance	0.15
Cost/ton	**0.95**

At a production rate of 8,600 tons/day, placing the remaining 3 million tons of waste rock in the American Girl Canyon would take 349 working days, or 1.39 years. Total estimated backfilling costs would be:

Production costs	
(3,000,000 tons x 0.95/ton)	$2,850,000
Overhead costs	
(1.39 years x $520,000/year)	726,000

TOTAL COST AMERICAN GIRL CANYON PIT BACKFILLING $3,576,000

Total cost for conducting a program for complete backfilling is projected at $6,999,000. The program would take approximately 38 months to complete. Complete backfilling would be a significant impact to project economics, and AGMJV has indicated it could

not mine the Oro Cruz deposits in a profitable manner under this alternative.

Air Quality

The additional handling of the waste rock material (transport from the waste rock dump to the Cross pit) would result in emissions of PM_{10}, NO^2, and CO. Because backfilling of the Cross pit would take place after all mining is completed, the total emissions generated during operations would remain the same as the proposed action. However, emissions resulting from this alternative would continue to impact air quality for an additional three years. The impacts to air quality from this alternative would not be expected to be greater than those estimated for the proposed action during mine life, and would not be significant.

Water Resources

Water consumption for dust control would be increased for an additional three years. This effect would not be significant.

Soils

Total backfilling of both Oro Cruz pits would not change the proposed disturbed areas because this alternative would require land to serve as a temporary waste rock dump at the site of the proposed permanent dump. Growth media underlying the temporary dump site may be lost or altered by compaction. Total backfilling would increase water and wind erosion and run-off at the dump site compared to the proposed action due to the extended time without covering vegetation. Effects would not be significant.

Vegetation

The vegetative disturbance for the operation under this alternative would be the same as the proposed action. Waste rock would be temporarily placed in a waste rock dump similar in ultimate ground disturbances potential to the proposed action.

Wildlife

The amount of disturbance would remain the same to wildlife for the life of the proposed operation. Revegetation of the area to suitable forage beneath the waste rock dump would begin later than the proposed concurrent revegetation during the mine life.

Visual Resources

The waste rock dump would create the same visual impacts from Key Observation Points as the proposed action during the life of the mine. However, the size of this dump would diminish as the Cross pit is backfilled following mining, thereby lowering the visual impacts caused by the waste rock dump. A portion of the pit highwall would remain because of the steep slopes.

Noise

Impacts from noise would be extended an additional three years due to the increased operation life. This effect would not be significant.

Transportation

Impacts to transportation would be extended an additional three years due to the increased operation life. This effect would not be significant.

Socioeconomics

Complete backfilling of the Cross pit would add three years of opportunities for employment and taxes in the 2 county impact area. However, since AGMJV has indicated it could not develop Oro Cruz in a profitable manner under this alternative, the beneficial employment and wage aspects would not occur if this alternative was selected.

ALTERNATIVE 3 -- CYANIDE SOLUTION APPLICATION VIA DRIP EMITTERS

AGMJV presently uses (and proposes to use under the proposed action) a system of impact sprinklers to distribute cyanide solution over the American Girl Canyon leach pad. This alternative analyzes drip application of cyanide solution during proposed Oro Cruz operations instead of sprinkler application. Other portions of the Oro Cruz operation remain the same as those proposed by AGMJV under this alternative.

Operational Rationale for Sprinklers

The decision to use sprinklers for cyanide application resulted from the requirement to discharge tailings from the mill circuit with cyanide concentrations below levels permitted by the WQCB, while at the same time maintaining a water balance in a closed (zero discharge) solution system. In order to reduce the cyanide content in the tailings to required levels, the tailings filtration system was equipped with fresh water sprays to wash the tailings cake prior to disposal. This fresh water ultimately becomes part of the solution inventory, with significant effects on the overall water balance. An increasing inventory presents a critical problem in that the storage capacity for solution is finite and excess capacity must be maintained at all times to accommodate a significant rainfall event.

During initial start-up of the mill process (November, 1990) it became apparent that the volume of water required for rinsing tailings, plus the fresh water introduced at other points in the process stream, exceeded the requirements to operate the heap leach and mill circuits. A net solution surplus developed and persisted. Since decreasing the amount of fresh water used in the tailings filtration process was not an option, maximum evaporation was seen as the solution to the water balance problem. To promote evaporation, sprinkler application of cyanide was adopted as part of the processing system. The use of sprinklers proved effective at establishing and maintaining the solution balance. Operating permits were changed to reflect the change and AGMJV is presently permitted to use either impact sprinklers or drip emitters for cyanide application.

Process Change to Agglomeration

In 1991 and 1992 the WQCB began directing significant reductions in the allowable cyanide levels for tailings disposed of on the waste dump. It was indicated that cyanide levels would have to be reduced to less than 1 ppm.

Investigations by AGMJV showed that additional fresh water rinsing of tailings, although nominally effective, had a significant deleterious effect on the water balance. AGMJV launched an in-depth study

of a number of options involving chemical neutralization of tailings and alternative disposal methods. Based on the study, it was decided to abandon tailings disposal on the waste rock dump and implement a system whereby tailings would be agglomerated with heap ore for ultimate disposal on the leach pad. By placing the tailings on the lined leach pad, the question of cyanide content in the tailings is no longer an issue until rinsing and closure of the heap leach facility. The agglomeration process was implemented in September, 1993 and efforts at optimization are currently underway.

Operational Effects of Switching to Drip Emitters

Metallurgical Accounting. The present system of rinsing tailings with fresh water, in addition to reducing cyanide levels, also reduces the amount of gold contained in the solution portion of the tailings product. With fresh water rinsing, the majority of the gold-bearing cyanide solution ultimately reports to the pregnant solution inventory and the gold is extracted as part of the mill production. A changeover to barren solution sprays (a requisite for drip emitters) complicates the metallurgical accounting in that an increased quantity of gold bearing solution contained within the tailings product would be transferred to the heap leach circuit in a largely undocumented fashion. For this reason, proper metallurgical accounting procedures must be in place prior to any changeover to barren solution sprays.

Water Balance. Promoting water conservation is one reason drip emitters are preferred for solution application in an arid environment. At the American Girl Project, it is estimated that drip emitters would reduce evaporative effects by 70 to 80 percent. With the change to agglomeration, fresh water introduction into ore processing would likely be greatly reduced or eliminated. There is some uncertainty, however, regarding the ultimate water balance situation after agglomeration is fully implemented. Water balance problems could lead to reduction of gold recovery, material handling problems and increases in the copper content of pregnant solutions, each of which could significantly jeopardize processing efficiency.

Cost. The cost of a complete changeover to drip emitters would be about $25,000. This figure reflects the cost of materials only. Labor costs for installation would be included if a "crash" program were implemented for overnight conversion. A more practical approach would be a gradual replacement of the current method as part of normal operation over a period of three to four months.

Hydrology

An established water balance can be upset by seasonal, heavy rainfalls. Without sprinklers, operational flexibility to handle this additional water would be reduced. If the rainfall event was large enough, impacts would be significant and jeopardize cyanide solution containment in ponds.

Wildlife

Drip emitters are considered superior to impact sprinklers from the standpoint of reducing wildlife, particularly *avian,* exposure to cyanide solution. Use of sprinklers promotes greater ponding of cyanide solution in small depressions on the surface of the leach pad. Use of drip emitters would reduce the

amount of solution ponding, thereby lessening the possibility of wildlife drinking cyanide solution from small ponds on the heap.

ALTERNATIVE 4 -- FLOATING COVER ON PONDS CONTAINING CYANIDE SOLUTION

AGMJV has proposed the continued use of nylon netting over ponds containing cyanide solution. This alternative analyzes the use of a floating polypropylene cover over the ponds rather than netting. Other portions of the Oro Cruz operation remain the same as those proposed by AGMJV under this alternative.

Operational Effects

A floating cover on the solution ponds would, in effect, eliminate any evaporative loss from the pond surface. The effect of these evaporative losses on cyanide solution and overall water balance is not known and would be dependent on whether other solution conserving measures, such as drip emitters, are being used.

The capital costs involved with abandoning netting and installing floating pond covers would be significant. In addition to the cost of the covers, new pumps would have to be installed. The estimated cost of a floating cover conversion would be $209,985 as shown in Table 41.

TABLE 41

ESTIMATED COSTS OF FLOATING COVER CONVERSION

Description	Cost
Pregnant Pond Liner (38,850 sq. ft. @ 1.50/sq. ft.)	$ 58,275
Barren Pond Liner (32,900 sq. ft. @ 1.50/sq. ft.)	49,350
Contingency (15%)	16,144
Total Cost of Liner	**$123,769**
2 @ 75 HP pumps with motor	$ 32,108
2 @ 100 HP pumps with motor	38,408
Labor to remove old pumps and barges and install new pumps. (5 workers x 5 days x 10 hr/day x $14/hr x 1.40 burden)	4,900
Downtime associated with conversion (10 hrs x 60 min. x 1200 gpm x 0.012 opt x 80% ads. eff. x $375 Au x 240 gal/ton)	10,800
Total Cost of Pumps and Installation	**$ 86,216**
TOTAL COST OF CONVERSION	**$209,985**

Air Quality

A floating cover would slightly lessen HCN emissions through reduced evaporation. Other effects would essentially be the same as the proposed action, and would not be significant.

Wildlife

The major environmental benefit of a floating pond cover would be to provide total wildlife exclusion to the pond area and eliminate the potential for wildlife getting caught in netting. The potential for cyanide related mortality in the pond area would be effectively eliminated.

Health and Safety

Under this alternative, there would be the slight risk that a person could slip beneath the cover, become trapped, and possibly drown or be poisoned. Other effects would essentially be the same as the proposed action, and would not be significant.

BLM'S PREFERRED ALTERNATIVE

BLM's Preferred Alternative contains elements from the Oro Cruz operation as proposed by AGMJV and Alternative 3 -- Cyanide Solution Application via Drip Emitters. BLM's Preferred Alternative would approve the action as proposed by AGMJV but require the use of drip emitters in place of impact sprinklers at the American Girl Canyon heap leach. It would provide for the occasional use of the sprinkler system on heap side slopes and allow the use of sprinkler application of cyanide solution under certain conditions, as described below. The potential environmental effects associated with the proposed action and Alternative 3 are described in previous discussions within this Chapter. The effects from BLM's Preferred Alternative would be the same as those described for the proposed action and Alternative 3, but would lessen the possibility of overflow of pond capacities and allow AGMJV to maintain necessary operational control of process chemistry and metallurgy.

Conditions for Implementation of Sprinkler Application

Under this alternative, it is anticipated that cyanide solution application via drip emitters would become the primary application method on the American Girl Canyon heap. Sprinkler application on heap leach side slopes would be allowed if one or more of the following significant operating conditions existed:

- *A major rainfall event and continued probability of additional rain poses a significant threat in terms of controlling solution balance and preserving pregnant solution grades. An event comprised of 1.5 inches of rainfall over a 24-hour period would impact pond levels to an extent requiring use of sprinklers to increase evaporative moisture losses for a period of time to maintain pond level control.*

- *Soluble gold loss has averaged 6.07 ounces per day since measurements began at the existing mill at American Girl Canyon. A reduction in tailings filtration efficiency which results in a substantial increase in soluble gold loss would be a significant event requiring the use of*

sprinklers. Soluble gold losses exceeding 8.28 ounces per day of gold would represent a threshold whereby corrective action could be taken. In this case, it would be necessary to re-introduce fresh water rinsing of tailings to reduce gold losses, and concurrently, maintain the solution balance.

- *The moisture content of mill tailings has averaged 20.8 percent during 1993. A reduction in tailings filtration efficiency resulting in an increase in moisture content of tailings to over 25 percent would pose a materials handling problem in conveying the wet, sticky, finely ground material up the incline to the top of the heap and would necessitate the use of sprinklers. To increase filtration efficiency, barren solution sprays in the filtration process would be replaced by fresh water, with sprinklers used as a countermeasure to promote evaporation and control the solution balance.*

- *Copper content within American Girl Canyon heap leach pregnant solution has averaged 773 ppm over the 1992-93 period. A significant increase in the copper content beyond a threshold value of 1,020 ppm would require the use of sprinklers on hillsides to enhance the control of copper in solution.*

The drip application system would be tested at the American Girl Canyon heap leach to demonstrate its effectiveness. In the event one or more of the above mentioned conditions develops, use of sprinklers would be implemented until problems are resolved. After the drip system is fully operational, use of sprinklers would occur on heap side slopes only on a temporary basis to correct short-term water balance problems, or a longer term basis to control potential metallurgical or process chemistry problems.

After the drip application system is installed and implemented, AGMJV would document all use sprinklers on the American Girl Canyon heap leach. This documentation would include a description of the action taken, rationale for the action and how the action meets one of the above conditions, duration of sprinkler use, and area of the heap put under sprinklers. AGMJV would notify BLM in writing of any anticipated use of sprinklers for 30 or more consecutive days.

For any use of sprinklers, AGMJV would be required to minimize the potential for ponding of cyanide solution by smoothing benches on side slopes and reducing major depressions. During heap leach detoxification and decommissioning, use of sprinklers for application of freshwater rinsing would be allowed in accordance with the American Girl Project Closure and Post-Closure Plan. No additional application of cyanide via sprinklers would be allowed in the detoxification/decommissioning process.

CHAPTER 5
CUMULATIVE IMPACTS

As discussed in Chapter 2 of this EIS, "cumulative" impacts are defined by Council on Environmental Quality regulations as "...the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions..." Actions to which the impacts of the proposed Oro Cruz operation must be added include activities which have occurred, are occurring, or may occur in the American Girl Project vicinity, and projects which exist or are proposed elsewhere in the region.

Chapters 2 and 3 describe the major types of activities which have occurred, are occurring, or may occur in the American Girl Project vicinity. These include current AGMJV mining and exploration activities, historic mining, and recreation activities at the adjacent Hedges/Tumco historic site. The proposed Oro Cruz operation would contribute to cumulative impacts of most elements of the human environment when considered in conjunction with other activities in the American Girl Project vicinity. These impacts are described below.

Existing and proposed regional projects elsewhere in Imperial County are also considered in the analysis of the cumulative impacts of the proposed Oro Cruz operation. Regional projects include:

- *Existing Mesquite Mine*
- *Proposed Mesquite Regional Landfill*
- *Proposed Chocolate Mountain Regional Landfill*
- *Proposed Calexico East Border Station and Route 7*
- *Proposed East Mesa Recharge and Recovery Wells*
- *Proposed El Centro Intermodal Loading Facility*
- *Proposed Southern Arizona Transmission Project*
- *Proposed Tamal Energy Co-Generation Project*
- *Proposed All American Canal Lining Project*

Table 42 identifies key characteristics of these projects. The approximate locations of the projects in Imperial County are shown on Figure 42.

The proposed action, when considered in conjunction with the regional projects listed above, would result in potential impacts to groundwater resources in the Amos-Ogilby alluvial basin, and biological resources, primarily desert tortoise habitat. These impacts are also described below. Cumulative impacts to other elements of the human environment would be similar in nature and extent to those projected for the proposed action by itself (see Chapter 4) due to the wide geographic distribution of these projects throughout the region.

It is unlikely that any identifiable cumulative impacts would occur from the addition of the proposed Oro Cruz operation to the East Mesa Recharge and Recovery Well, the El Centro Intermodal Loading Facility, the Southern Arizona Transmission Project, or the Tamal Energy Co-Generation Project. Therefore, these projects are not addressed in any further detail.

TABLE 42

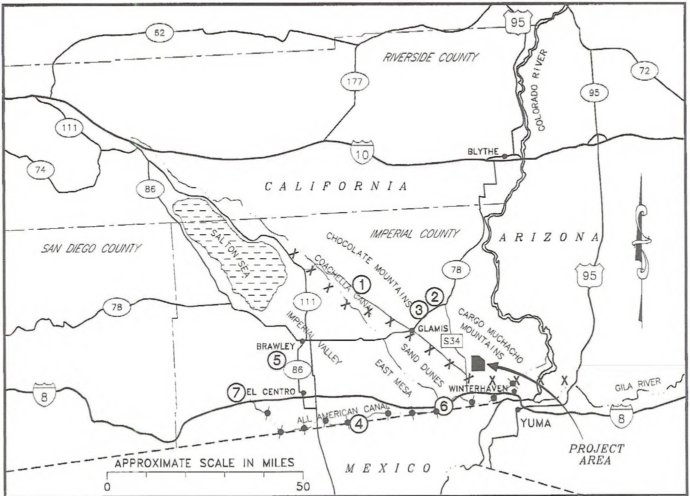
CHARACTERISTICS OF REGIONAL PROJECTS CONSIDERED IN CUMULATIVE ANALYSIS

Project Characteristics	Proposed Chocolate Mountain Regional Landfill	Existing Mesquite Mine	Proposed Mesquite Regional Landfill	Proposed Calexico East Border Station & State Route 7	Proposed Southern Arizona Transmission Project	Proposed Tamal Energy Co-generation Project	Proposed East Mesa Recharge/ Recovery Wells	Proposed El Centro Intermodal Loading Facility	All-American Canal Lining Project
Approximate Distance from Proposed Action	38 miles	17 miles	17 miles	14 miles	Passes within approx. 1 mile (nearest alternative)	45 miles	14 miles	57 miles	Nearest point is approx. 10 miles
Approx. Total Project Area	3,480 acres	5,200 acres	4,274 acres	159 acres	Varies by Alternative	10 acres	Unknown	Unknown	1,100 acres
Approx. Area to be Disturbed	1,200 acres	4,000 acres	2,290 acres	159 acres	Varies by Alternative	None	Unknown	Unknown	1,100 acres
BLM Managed Land	1,150 acres	3,100 acres	1,878 acres	None	Varies by Alternative	Unknown	All affected land	Unknown	1,100 acres
Daily Truck Highway Traffic	Unknown	9	370 round trips	Unknown	Unknown	Unknown	0	Unknown	Unknown
Groundwater Requirements (acre-feet/year)	0	1,000	4,033	250 by year 2015	No long-term requirements	Unknown	1,000 to be replaced each year	Unknown	Would reduce water seepage by 67,700 acre-feet
Number of Employees	262	370	268	Unknown	Unknown	Unknown	Unknown	Net loss of 19 local jobs	Peak of 240
Anticipated Operating Period	100 years	10 to 15 years (until 2004 to 2009)	100 years	1995	Unknown	Unknown	1 year	Anticipated Start - January 1994	3-year construction period

Data compiled by Butler Roach Group, Inc. and BLM for Mesquite Regional Landfill EIS/EIR

Data Sources:

Chocolate Mountain Regional Landfill, Application for Development, September 1992.
Mesquite Regional Landfill Draft EIS/EIR, in preparation.
Calexico East Border Station Final EIS, August 1993.
Imperial County Planning Department
East Mesa Recharge Demonstration Recovery Wells Scope of Services Proposal to Imperial County Planning Department, no date.
El Centro Intermodal Loading Facility Proposal, August 30, 1993.
All-American Canal Lining Project, Draft EIS, May 1991.



Legend

1. Proposed Chocolate Mountain Regional Landfill
2. Existing Mesquite Mine
3. Proposed Mesquite Regional Landfill
4. Proposed Calexico East Border Station and State Route 7
5. Proposed Tamel Energy Co-Generation Project
6. Proposed East Mesa Recharge/ Recovery Wells
7. Proposed El Centro Intermodal Loading Facility

●●● All American Canal Lining Project

XXX Proposed Southern Arizona Transmission Project (nearest alternative)

FIGURE 42

PROJECTS CONSIDERED FOR REGIONAL CUMULATIVE IMPACT ANALYSIS

THE ACTION AS PROPOSED BY AGMJV

The most obvious cumulative effects from implementation of the proposed Oro Cruz operation would relate to the extent, scope and timing of the overall American Girl Project. If the proposed action is implemented, the overall American Girl Project would disturb an additional 191 acres, bringing the cumulative projected disturbance to 809 acres; extend the life of the overall project by 2-3 years; and produce additional 3 million tons of ore and 8.5 million tons of waste rock compared to current operations at Padre Madre and American Girl Canyon. Potential cumulative effects from the proposed action to each element of the human environment are discussed below.

Climate & Air Quality

Cumulative impacts are based on emissions from the proposed Oro Cruz operation as well as emissions from other existing and proposed sources. However, since air quality effects from the proposed action would be localized to American Girl Project receptor locations, cumulative impact analysis for air quality considers only the Oro Cruz operation in conjunction with the American Girl Canyon operation.

Cumulative emissions and impacts associated with combined Oro Cruz and American Girl Canyon activities are derived in the following manner: Emissions from any sources currently in use at the American Girl Canyon site that will remain in use and at their current location during Oro Cruz operations (i.e. crushing, milling, leaching, agglomeration, and generators) are estimated using current American Girl Canyon activity rates. These emissions are then combined with the emissions that would be associated solely with the proposed Oro Cruz operation and input into the model to yield cumulative impacts.

Maximum cumulative impacts for PM_{10}, SO_2, NO_x, and CO are presented in Table 43 along with baseline concentrations, location of the receptor with the highest impact, and federal and state standards. Cumulative impacts are modeled in the same manner(i.e. using the same models, technical options, etc.) as for Oro Cruz modeling.

The increase in impacts from combined Oro Cruz and American Girl Canyon emissions would be relatively small (ranging from no increase to $0.8\mu g/^m$ at the maximally impacted receptor) for PM_{10}, SO_2, and CO. Therefore, significance issues discussed in the Oro Cruz impacts section (in Chapter 3) relating to these pollutants would remain the same for cumulative impacts. Modeled exceedances of the California 24-hour PM_{10} standard from cumulative impacts are presented in Figure 43.

Both short-term and annual cumulative NO_x impacts would increase as compared to impacts from the Oro Cruz operation alone. Short-term impacts would increase by 325 $\mu g/^m$ and annual impacts would increase by $6.5\mu g/^m$. This is due primarily to the use of five generators at the American Girl site. Although the method employed to control NO_x emissions from these generators has not yet been decided, emissions would be controlled to a level sufficient to restrict annual emissions of NO_x from the generators to less than 250 tons per year. (The specific method of NO_x control would be determined during the Authority to Construct and Operating Permit processes to commence in January of 1995).

TABLE 43

MAXIMUM ESTIMATED CUMULATIVE AIR IMPACTS

Pollutant	Averaging Increment	Maximum impact $\mu g/^m$	Baseline $\mu g/^m$	Total conc. $\mu g/^m$	Location	NAAQS $\mu g/^m$	California Ambient Standard $\mu g/^m$
PM_{10}	24-hour	37.7	26.0^{+}	63.7	WSW of pit	150	50
	Annual	3.2	18.9*	22.1	S of pit	---	30*
	Annual	3.2	26.0^{+}	29.2	S of pit	50	---
SO_2	1-hour	31.0	NA	31.0	W of pit	---	655
	3-hour	16.9	NA	16.9	WNW of pit	1,300	---
	24-hour	3.6	NA	3.6	ESE of pit	365	105
	Annual	0.3	NA	0.3	ESE of pit	80	---
NO_x	1-hour	786.0	NA	786.0	SE of pit	---	470
	Annual	11.0	NA	11.0	SE of pit	100	---
CO	1-hour	636	NA	636.0	W of pit	40,000	23,000
	8-hour	158	NA	158.0	WSW of pit	10,000	10,000

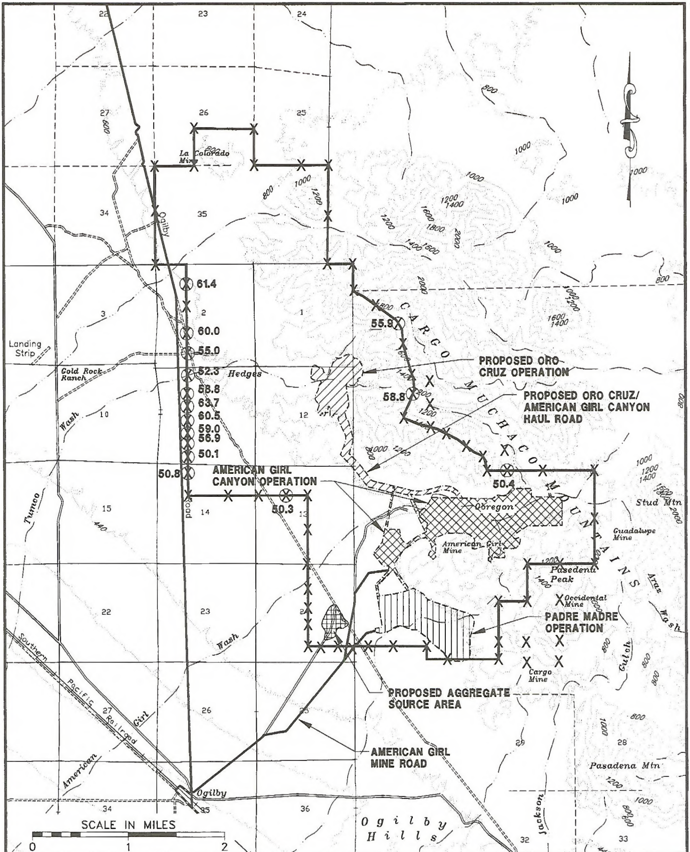
+ = 5-year arithmetic mean of complete data years at Gold Rock Ranch PM_{10} monitoring station

* = Geometric mean

NA = data not available

Source: Air Sciences Inc., 1993.

Cumulative NO_x impacts continue to remain below the national ambient air quality standard. However, these impacts are modeled to exceed the California 1-hour standard in two small areas (along the project boundary north and south of the American Girl Canyon operation). Examination of these exceedances indicates that maximum impacts would occur during early morning/late evening hours when the wind speeds are typically low and poor mixing occurs. Because the mining equipment would operate on a 20-hour schedule, it is likely that most mobile equipment would not be operating at these times. This should result in reduced impacts as compared to the modeling results which assume mobile equipment is continually operational. Modeled exceedances of the 1-hour California NO_x standard from cumulative impacts are presented in Figure 44.

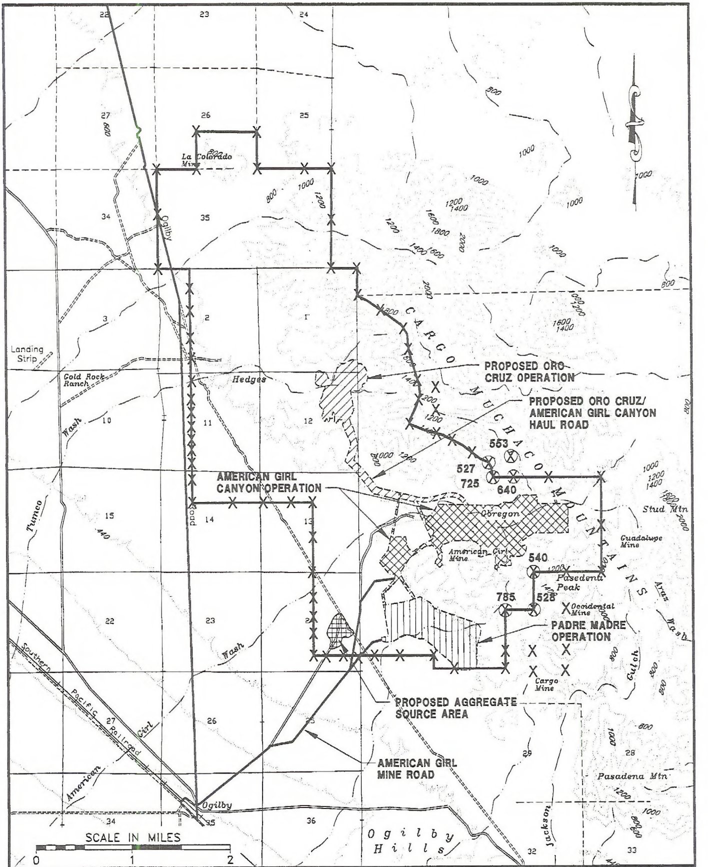


X MODEL RECEPTOR LOCATION WITHIN REGULATORY LIMITS

⊗ RECEPTORS WITH EXPECTED EXCEEDANCE OF STANDARD

FIGURE 43

CUMULATIVE IMPACTS (in ug/m^3)
PM$_{10}$ 24-HOUR CALIFORNIA STANDARD
(50 ug/m^3)



X MODEL RECEPTOR LOCATION WITHIN REGULATORY LIMITS

⊗ RECEPTORS WITH EXPECTED EXCEEDANCE OF STANDARD

FIGURE 44

CUMULATIVE IMPACTS (in ug/m^3)
NO_X 1-HOUR CALIFORNIA STANDARD
(470 ug/m^3)

Geology

The proposed Oro Cruz operations would continue the historic and recent trends of mining and waste rock disposal in the American Girl Project area. Because mining is considered an appropriate use of resources in the area according to BLM and County land use guidelines, the proposed mining and waste disposal would have a low adverse cumulative impact on geology and geotechnical issues on both a local and regional basis.

Hydrology

Surface Water Hydrology. Historic mining activities have altered natural surface water flow patterns. The impacts of planned Oro Cruz operations on surface water hydrology would include further changes to surface water flow patterns in the immediate vicinity of the mine pits and waste rock dump. The impact of these operations on sedimentation, erosion, and surface water quality would not be significant. Proposed mining and waste disposal would not have a significant cumulative impact on surface water hydrology in the Tumco Wash valley. The proposed action would have no measurable cumulative effect on the regional area.

Ground Water Hydrology. Past and current activities in the American Girl Project vicinity have had a negligible effect on groundwater resources. The potential impacts of planned Oro Cruz operations on groundwater hydrology would consist of leaching of precipitation through waste rock into groundwater beneath Tumco Wash and American Girl Canyon, and leakage of leach process solutions into groundwater beneath American Girl Canyon. The impact of leaching of precipitation through waste materials would not be significant due to the geochemical characteristics of the waste materials and the low rate of percolation on site. A major leakage of process solutions would be significant, but the performance of the leach facility is monitored with a series of wells. Planned mining and waste disposal would not have a significant cumulative impact on groundwater hydrology in the Tumco Wash valley and American Girl Canyon.

The existing Mesquite Mine and the proposed Mesquite Regional Landfill are the only other facilities in the vicinity of the proposed action that result in a loss of groundwater from the Amos-Ogilby Basin. If these projects and the proposed action were implemented, the Amos-Ogilby Basin would continue to experience a net recharge and water availability would not be affected.

The proposed All-American Canal Lining Project would substantially reduce recharge of the Amos-Ogilby Basin (by 67,700 acre-feet/year). Because the Amos-Ogilby Basin would still receive a net recharge from the Colorado River, rainfall infiltration, and the All-American Canal (it is estimated that approximately 15,000 acre-feet/year would still leak from a lined canal), cumulative impacts would not be significant.

Soils

The cumulative impacts to soils would be similar to the changes in structure and texture as discussed above. A mixed rocky material with variable amounts of fines and cobbles (depending on the source of the materials) would be the soil substrate

remaining after mining and rough grading is completed at all three American Girl Project sites. Mine waste rock dumps and ore leach heaps would consist of partially decomposed and broken rock that would support the desert vegetation at a cover and productivity similar to the surrounding slopes. The other reclaimed surfaces of the roads, processing and service areas would be composed of in-place and graded material, and would also be revegetated by seeding and spreading of the surface soil materials that have been saved as a seed source. The proposed action would not contribute to any identifiable cumulative effects on a regional scale.

Vegetation

The general impacts on vegetation of the Oro Cruz disturbed areas are similar to impacts experienced on the existing American Girl Canyon and Padre Madre operations. These impacts are destruction of vegetation through activities for waste rock removal, mining ore, establishing mine waste dumps and road construction for access, and ore and waste rock handling.

The total American Girl Project (including Oro Cruz) surface area that would be actively reclaimed is 382 acres of roads, facilities, mine pits, mine waste dumps, and leach heaps. The remaining surfaces are steep sides of mine pits, outer slopes of mine waste dumps and other inaccessible areas such as cut and fill slopes which cannot be reclaimed. The loss or disturbance of vegetation associated with the proposed action would not contribute to any identifiable long-term cumulative effects on a regional scale.

Wildlife

The human impacts that have affected wildlife habitats and populations in the Cargo Muchacho Mountains include current mining-related disturbances, historic mining activities, and recreational activities. Recently permitted and pending mining disturbances associated with the Padre Madre and American Girl Canyon Operations total 618 acres, with wildlife affected to some degree in surrounding areas totalling several times that acreage. The proposed operation would result in an additional 191 acres of short- to long-term disturbance in an adjacent drainage.

Cumulative, contemporary mine disturbance would then total 809 acres. Historic mining disturbed several times that acreage, adversely affecting the local wildlife population. Many of the historic disturbances have progressed substantially in healing themselves since the 1930's, and disturbances (e.g., mines and open water sources) are now important wildlife habitats that warrant protection and mitigation.

Cumulatively, these historic mining impacts have affected thousands of acres of habitat in all drainages of the Cargo Muchacho Mountains, Although the status of historic wildlife populations is unknown, most wildlife species have probably been adversely affected to a minor degree. Some rarer, vulnerable species with low reproductive rates, such as the desert tortoise, may have incurred more significant negative effects, while other species, such as the red spotted toad and California leaf-nosed bat, have probably benefitted to where their populations are currently near historic highs.

From an overall wildlife community perspective, implementation of the proposed Oro Cruz operation would generally affect a smaller area of less valuable habitat over a shorter time period than that associated with either the American Girl Canyon or Padre Madre operations. This is partially the result of mining previously disturbed habitats and using existing ore processing facilities at American Girl Canyon. While the proposed Oro Cruz operation would be a small additional impact, relative to American Girl Canyon or Padre Madre, it would affect wildlife in both drainages for the life of the operation, until habitats have been at least partially reclaimed.

The historic mining disturbances in Tumco Wash have created a broad, barren, landscape that is at least a restriction, if not a barrier, to some less mobile wildlife. The anticipated mining disturbances and the physical, short-term obstacles presented by mine facilities and associated fences would further restrict or preclude the movements of some terrestrial species. For the majority of affected species, such a restriction would be unrecognized or only pose an inconvenience. For some less mobile species (such as the desert tortoise, discussed further, below), confinement by a fence to an inadequate area of year-round habitat could be fatal.

The proposed operation would result in the take of desert tortoises through loss of habitat and through limited harassment and, possibly, direct mortality. The anticipated take associated with the proposed Oro Cruz operation would be small, but additive to the cumulative effects of historic mining, recreational use, and current American Girl Canyon and Padre Madre Mining. Implementation of the proposed action would result in an estimated loss of 246 acres of Federally-managed desert tortoise habitat. With recommended mitigation measures, this loss of habitat would be compensated for through the purchase of a similar acreage of tortoise habitat on private lands by AGMJV. This land would be deeded to, and subsequently managed by, BLM.

From a more regional perspective, the proposed Oro Cruz operation would only affect the Chuckwalla Bench population of desert tortoise, and would be located outside of critical habitat as designated by the USFWS. The proposed action would not impact any other desert tortoise population and would not jeopardize the existence of the Chuckwalla Bench desert tortoise population. Therefore, only cumulative impacts to the Chuckwalla Bench desert tortoise population are considered in this analysis.

Biological resources associated with the existing Mesquite Mine and the proposed Mesquite and Chocolate Mountain Regional landfills have been or would be identified and analyzed for site-specific impacts in the environmental documents for each project. As with the proposed Oro Cruz operation, each of the regional landfill projects would be located in a lowest priority Category III desert tortoise habitat area. These Category III areas are so designated because they are not considered essential to maintenance of viable populations, have relatively low tortoise densities, and have unresolvable conflicts (e.g., between habitat and land uses). A net loss of desert tortoise habitat would occur. However, the total area of cumulative impact from each of these projects would be relatively small compared to the total habitat area of the Chuckwalla Bench desert tortoise population.

Each of the projects in desert tortoise habitat would be required to complete Section 7 consultation and

obtain a biological opinion from the USFWS. Measures to mitigate desert tortoise impacts would be specified through this process. The mitigation measures implemented for each project (including the proposed Oro Cruz operation -- see Chapter 4) would include at a minimum various combinations of the following types of activities:

- *Initial site clearance and relocation of desert tortoise by a trained person;*
- *Fencing to preclude re-entry;*
- *Construction and operations worker and visitor training;*
- *Provisions to prevent vehicle-related mortality;*
- *Provisions to minimize the attraction of tortoise predators (e.g., ravens);*
- *Off-site compensation by transferring ownership of privately-owned Critical or Category I habitat land to federal ownership and protection based on a ratio formula designated by the BLM in consultation with the USFWS; and/or*
- *Speed controls for unfenced access roads.*

Implementation of these measures would not result in significant cumulative impacts to the desert tortoise.

The most significant potential wildlife mortality source would be the accelerated deterioration of mines outside, but adjacent to, the mining area. All of these mines have partially collapsed inside and some, such as the Golden Crown, an important *Macrotus* roost, are so unstable that large portions of the mine, where bats typically roost, are no longer surveyed. Bat use of these adjacent mines would probably increase as bats from adjacent impacted mines are displaced. Blasting and other mine-related activities could de-stabilize surrounding mines resulting in the direct mortality or entombment of larger numbers of bats than are now present in these mines.

Land Use

As the third operation of the American Girl Project, the proposed Oro Cruz operation would bring the cumulative disturbed acreage of the project to 809 acres. Impacts from the proposed action would occur within an area which has both existing mining operations and a long history of mining disturbance. Mining is an acceptable land use in the area in terms of current land use policies. Overall, cumulative impacts would be minimal on both localized and regional bases,, and there would be no unnecessary or undue degradation of Federal lands.

Recreation

Conversion of the proposed Oro Cruz operational area from open space (available for recreation) to mining would continue the trend associated with the existing American Girl Project operations. However, there are relatively abundant nearby lands which can be used as substitutes for geological and scenic resources within the entire American Girl Project area. Cumulative impacts to users of regional recreation resources would constitute a low adverse effect.

Development of the proposed action would lead to an increase in recreational visitation to the localized area due to increased interest in gold mining from both a historical and current-day perspective. Visitor surveys conducted in areas with gold mines generally indicate that persons are interested in gold mining history, and would be interested in mine tours or

other opportunities to learn about gold mining. This fact, along with the existence of the Tumco /Hedges historic townsite adjacent to the Oro Cruz proposed site, indicates that public interest in gold mining at Oro Cruz would increase. From a cumulative perspective, Oro Cruz development would have a moderate impact when considered in conjunction with current recreational uses of the Tumco/Hedges historic area. Adverse effects would be mitigated through a pedestrian interpretive trail to be developed and maintained by AGMJV. The trail would provide for appropriate signage and literature to document historic and current mining operations.

Visual Resources

The visual impacts of the three American Girl Project operations would occur simultaneously over the 1993-1998 period. From a visual perspective, each operation would be relatively separate and independent. From each designated KOP, activities at one operational site would not directly add to the effects observed at other sites. However, the proposed operation would incrementally reduce the overall visual resources of the regional landscape. Surface disturbance due to mining activity is common in the project area. Once the American Girl Project is completed, the remaining highwalls, waste dumps, and heap leach pads would add to the already disturbed landscape. KOPs 1 and 2 described the direct impacts associated with proposed Oro Cruz development. The proposed action would not be seen from KOP-3. KOP-3 is included in this cumulative impact discussion because it is the view of the overall project area seen by travellers on Interstate 8, the most heavily travelled major road in the vicinity. Table 44 summarizes the cumulative visual contrast of the American Girl Project as a whole. The proposed action would not significantly contribute to any identifiable effects on regional visual resources.

KOP-3 is located at the intersection of Ogilby Road at Interstate 8 (VRM Class II). Travelers on Interstate 8 currently have distant views of the Oro Cruz vicinity, but no direct views of the actual Oro Cruz site. There is minimal visual contrast of the existing operations to the surrounding landscape from at Interstate 8 due to the distance and direction from which motorists view the project site. Visibility of the project during daytime hours by motorists travelling east-bound on Interstate 8 include the Padre Madre heap leach pad. This is a background view (over five miles in distance) and the impact is negligible (see Appendix C, Figure C-3). The foothills of the Cargo Muchacho Mountains west of the project site block all views of the project facilities

TABLE 44

CUMULATIVE AMERICAN GIRL PROJECT VISUAL CONTRAST

Key Observation Point	Operational Phase		Post-Operational Phase	
	Daytime	Nighttime	Daytime	Nighttime
KOP-1, Ogilby Rd. at Gold Rock Ranch Rd.	M	L	M	O
KOP-2, Ogilby Rd. near American Girl Canyon	M	L	M	O
KOP-3, Ogilby Rd. at Interstate 8	L	O	L	O

O - No contrast L - Low contrast M - Moderate contrast

for west-bound travellers on Interstate 8. The angular form of the heap leach pad only weakly contrasts with the massive irregular backdrop of the Cargo Muchacho Mountains. The light hues from project disturbances (similar in value to the scars on Kyanite Hill, which is clearly visible from this KOP) weakly contrast with the dark hues of the mountainside because of distance and prevalent haze in the area. Thus, there is minimal identifiable visual impact from KOP-3 and visual contrasts do not exceed CDCA Plan Class M visual objectives.

After operations are completed at all 3 operations, mine and heap leach pad elements of the Padre Madre operation would be visible primarily from KOP-3, the heap leach and waste rock dump elements of the American Girl Canyon operation would be visible from KOP-2, and the mining pits and waste rock dump of the proposed action would be visible from KOP-1. Remaining mine and processing elements would be lighter in value and hue than surrounding terrain, would have a rectangular form and horizontal line versus irregular massive form and vertical line of the mountains, and would have a fine smooth texture compared to the coarse texture of the surrounding talus slopes. Reclamation measures would reduce contrasts of form and line by blending mine element contours into the surrounding terrain but would not reduce color contrasts. Color contrasts would be mitigated by the requirement that AGMJV paint visible facilities a desert tan or other color acceptable to BLM.

Sound

No significant differences in cumulative sound impacts are expected as compared to impacts solely from proposed Oro Cruz operations because there would be no increase in numbers of vehicles or equipment, nor in noise generating activity levels associated with current American Girl Project operations. Effects would be localized, and the proposed action would not contribute to any identifiable cumulative effects on a regional basis.

Cultural Resources

The disturbance of cultural resources by proposed Oro Cruz development would add to those disturbances already created by the Padre Madre and American Girl Canyon operations. Several cultural resource studies were undertaken in advance of the construction of mining and processing facilities in American Girl Canyon. Historic sites disturbed by American Girl Canyon operations include 4-Imp-5393H (a 1914 historic mining locality), 4-Imp-3303H (the townsite of Obregon), 4-Imp-5394H (east features), 4-Imp-5394H (west features), 4- Imp-5396H (extended mining of the Padre-Madre claim), 4-Imp- 5397H (kyanite mining), and 4-Imp-5399H (early mining of Obregon).

Sites 4-Imp-5393H, 4-Imp-3303H, and 4-Imp-5399H were "proposed as members of a discontinuous historic district and together contain qualities that fit the requirements for a National Register of Historic Places site or district" (Hector and Van Wormer, 1988). The study by Hector, et al. (1991) detailed the data recovery undertaken at sites 4-Imp- 5393H (a 1914 historic mining locality) and 4-Imp-3303H (Obregon). Site 4-Imp-5399H "was not subject to the mitigation program, because it is located outside the area of impacts associated with the current mining activities" (Hector, et al., 1991).

An inventory in the Padre Madre mine area initially recorded site 4-Imp-5300H and three isolated scatters. Site 4-Imp-5300H was recommended not eligible for the NRHP (Hector and Van Wormer, 1987).

From a cumulative perspective, the proposed action would have a moderate impact when considered in conjunction with the current recreational uses of the Tumco/Hedges historic area and the potential for increased recreational usage of the area. There would be a direct view of the proposed operations and a potential increased interest in gold mining from both a historical and current-day perspective. This would indirectly lead to an increased recreational use of the Tumco/Hedges area by the public, which could result in increased vandalism. The existing mantle of tailings overlying much of the historic townsite also presents public safety concerns because of the unstable nature of the tailings. Mitigation measures would restrict public access to any hazardous areas associated with the proposed action. With mitigation, the proposed development would not significantly contribute to regional cumulative impacts.

Transportation

There are no other existing or proposed industrial projects in the vicinity which would add to the traffic associated with proposed Oro Cruz development. However, the potential for additional recreational interest in the area is discussed in the Recreation and Cultural Resources sections of this Chapter of the EIS. If there is an increase in the number of recreationalists who frequent the Hedges/Tumco historic area adjacent to proposed Oro Cruz operations, these visitors would increase the number of trips to the American Girl Project area along Interstate 8, State Highway 79, and Ogilby Road. These roads are capable of handling this additional traffic, and the overall effect from the proposed action would be a negligible cumulative impact on both a local and regional basis.

Socioeconomics

The American Girl Project currently generates over $290,000 a year in Imperial County property taxes. From the perspective of all revenues accruing annually to the County through property taxes, the existing project does not substantially increase the tax base. However, because the project is highly self-sufficient in terms of the services normally provided by the public sector through tax dollars, the revenue returned from the existing project to the county exceeds County costs for servicing.

According to Imperial County Assessor's Office policy, the proposed Oro Cruz operation would be assessed as a separate mining operation from the existing Padre Madre and American Girl Canyon operations. Proposed Oro Cruz development would replace some of the assessed valuation lost as Padre Madre operations are closed. While the proposed action would still not represent a substantial portion of the Imperial county tax base, (with or without the other regional cumulative environment projects listed above), property tax revenue from the American Girl Project would be extended an additional 2-3 years if the proposed action was approved and developed.

While Imperial County would gain revenue from property taxes directly associated with the project, Yuma County would primarily gain indirect revenue from sales and property taxes paid by the estimated

95 percent of AGMJV employees living in the Yuma area. These employees pay the sales and property taxes primarily through use of their wages to purchase goods and housing units, respectively. Proposed Oro Cruz development would continue the availability of wages for sales and property tax payments for an additional 2-3 years beyond existing operations.

The private and public economies of the 2-county area would also be stimulated by continued direct expenditures for purchase of materials, supplies, and services from local vendors and providers. A portion of these expenditures would be for purchases subject to state sales tax. These payments by AGMJV to local vendors and providers create indirect jobs and wages which would be spent in the local economies.

On a regionalized scale, the proposed action would contribute a negligible amount to the regional southern California/western Arizona economy. The other regional projects considered for cumulative impact analysis may have a much greater effect (individually and collectively) on Imperial County tax base, tax revenue, and employment compared to the proposed Oro Cruz operation.

CHAPTER 6

OTHER REQUIRED CONSIDERATIONS

In addition to information and analysis contained in Chapters 1-5 of this EIS, NEPA requires several other EIS analyses and disclosures. These other required considerations include:

- *unavoidable adverse impacts*
- *irreversible and irretrievable commitment of resources*
- *short-term use versus long-term productivity*

Each consideration is discussed below.

UNAVOIDABLE ADVERSE IMPACTS

Most of the foreseeable impacts to the existing environment would be adequately mitigated by the elements incorporated by AGMJV into the proposed action and the mitigation measures proposed in Chapter 4 of this EIS. However, unavoidable adverse impacts would still occur if the proposed action were implemented.

Unavoidable adverse impacts may be short-term or long-term and direct or indirect. Unavoidable adverse impacts may also be significant or not significant after the application of mitigation. For example, some short-term unavoidable adverse impacts to vegetation may be adequately mitigated by post-mining reclamation, and, therefore, these impacts would not be significant.

Development of the Oro Cruz operation as proposed by AGMJV would result in some unavoidable adverse impacts to topography, land use, vegetation, wildlife, cultural resources and visual resources. These unavoidable adverse impacts are described in the "Residual Effects" sections in Chapter 4 of this EIS. The only significant unavoidable adverse impact projected to occur with implementation of the proposed action is to California leaf-nosed bat (*Macrotus*) because of the destruction of the maternity and winter roost in the historic Golden Queen mine. Due to project location/design and mitigation measures, there would be no other unavoidable adverse impacts to the human environment.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible commitment of resources results when actions alter an area to the point where it cannot ever be restored to its undisturbed condition. Also, a commitment that completely consumes or removes a non-renewable resource is considered an irretrievable commitment of that resource. The following section discusses irreversible or irretrievable commitments of the proposed action.

Climate and Air Quality

With proposed operation implementation, there would be short-term increases in air emissions. The proposed action would meet all applicable air quality standards.

Geology

An estimated 3 million tons of ore having about 80,000 ounces of gold would be committed to the marketplace. About 8.5 million tons of waste rock would be committed to surface disposal, pit backfilling or operational use.

Topography

Some surface structures and topographic features would be committed to remain in place for the long-term.

Water Quality

There would be no significant short-term or long-term commitment affecting water quality.

Water Use

Water consumed during the proposed operation would be unavailable for other uses.

Vegetation

Disturbance would result in a long-term commitment of about 191 acres. Revegetation would be difficult under harsh conditions in the area. Therefore, all disturbed areas would not be fully returned to pre-mining conditions.

Wildlife

There would be a short-term commitment of wildlife resources through loss of habitat, direct mortality and displacement.

Land Use

There would be a short-term commitment of land use for facilities. Surface facilities would be located on lands zoned for mining. Post mining land use would return most land to wildlife habitat/open space.

Recreation

There would be no long-term commitment. Mining would provide a short-term opportunity for increased recreational interest in the area.

Visual Resources

The proposed operation would result in a long-term commitment to changes in existing visual resources. The effects would be lessened because of the prevalence of historic disturbances and because development would be located in general conformance with existing land use plans.

Cultural Resources

A Treatment Plan would be designed and implemented to mitigate adverse effects to any cultural resources eligible for or contributing

to NRHP listing. No long-term commitments are expected unless unknown cultural resource sites are not mitigated when discovered.

Transportation

The proposed operation would not result in any short- or long-term significant commitment.

Socioeconomics

The proposed operation would result in a peak short-term commitment of 174 jobs at the mine, plus an estimated additional 87 indirect jobs in the area. No commitments to population, housing or government services would occur with implementation of the proposed action.

Other Resources

A peak annual consumption of 1.7 million gallons of diesel fuel and 30,000 gallons of gasoline would constitute an irretrievable commitment of these resources.

SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY

This section discusses the balance between the short-term use of the proposed Oro Cruz site and the long-term productivity provided by the site without the operation. The current uses of the site include mineral exploration, open space, recreation and wildlife habitat. Productivity from the site if the proposed action is approved would be gold production. If the proposed action is implemented, some of the short-term uses of the site would be changed or altered for the approximate 4-year life of the operation. Wildlife habitat would be reduced, as the site disturbances would cause a loss of vegetation. If the proposed operation were not implemented, current uses and levels of productivity would continue.

Following closure and revegetation, land use and productivity of the site would be similar to the conditions that existed prior to operations. A portion of the disturbed area (56 acres) would be permanently removed from vegetation production, but the remainder of the site (135 acres) would be revegetated according to terms of the proposed reclamation.

CHAPTER 7

LIST OF PREPARERS

Bureau of Land Management

G. Ben Koski, Area Manager
El Centro Resource Area

Thomas Zale, Multi-Resource Staff Chief
El Centro Resource Area
Project Lead

Garth Portillo, *formerly* Archeologist
California Desert District
Cultural Resources

Kerry Schwartz, Range Conservationist/Botanist
El Centro Resource Area
Vegetation and Soils

Rob Waiwood, Minerals Resource Planner
California Desert District
Plan of Operations Review

James Watkins, Wildlife Biologist
El Centro Resource Area
Wildlife

Patricia Weller, Archeologist
El Centro Resource Area
Cultural Resources

P.M. De Dycker & Associates, Inc. (BLM Contractor)

Phillip De Dycker, B.S. Environmental Engineering, 21 years experience
EIS Project Director

Michael Stanwood, M.S. Mineral Economics, 15 years experience
Project Manager, Public Involvement, Land Use, Socioeconomics, Visual Resources, Transportation, Recreation

Richard Thompson, B.S. Wildlife Research/M.S. Zoology & Physiology, 12 years experience
Biological Coordinator, Wildlife

Clint Strachan, M.S. Civil Engineering/B.S. Agricultural Engineering, 14 years experience
Engineering/Water Resources

George Chedsey, B.S. Civil Engineering, 16 years experience
Remediation/Closure

Samuel Bamberg, Ph.D. Ecology,Soils/M.A. Ecology/B.A. Biology,Geology, 23 years experience
Wildlife, Vegetation, Soils

Ingrid Hanne, B.A. Biology/M.S. Range Science, 10 years experience
Vegetation

Michael Burney, B.A. Anthropology/M.A. Archaeology, 18 years experience
Cultural Resources

Rodger Steen, B.S. Engineering/M.S. Geofluid Dynamics, 18 years experience
Air Quality/Climate, Noise

Dave Randall, B.S. Land Resource Planning/M.S. Progress, Civil Engineering, 7 years experience
Air Quality/Climate, Noise

Lynn Pellini, B.A. Chemistry/M.S. Analytical, Environmental Chemistry, 3 years experience
Air Quality/Climate, Noise

Bruce Jordan
Drafting

Lori Russell
Assistant

CHAPTER 8

CONSULTATION AND COORDINATION

Extensive efforts were made to involve the public and other governmental agencies in this EIS process. Scoping and consultation activities are summarized below.

Scoping

A Notice of Intent (NOI) to prepare an EIS for the proposed Oro Cruz operation was published in the Federal Register on Friday, June 5, 1992. The NOI also announced the dates, times and places for public scoping meetings which were held in El Centro, California and Yuma, Arizona. The public scoping meetings were held on June 30, 1992 in El Centro and on July 1, 1992 in Yuma. The NOI also served as notice to solicit written comments on the proposed action; the written comment period was from June 5 through July 17, 1992. Two comment letters, from the U.S. Bureau of Mines and the U.S. Environmental Protection Agency, were received by BLM during the written comment period. Additional information on public participation, scoping and the development of significant environmental issues is contained in Chapter 1 of this EIS.

Consultation

Consultation with local, state and federal agencies was conducted as a part of this EIS process. Agencies consulted include:

- *Imperial County Planning Department*
- *Imperial County Air Pollution Control District*
- *Imperial County Economic Development Commission*
- *Imperial County Regional Economic Development, Inc.*
- *Yuma Economic Development Corporation*
- *U.S. Fish & Wildlife Service*

These consultations were conducted in order to ensure that all available information was incorporated into the EIS.

List of Agencies and Organizations to Whom Copies Of this EIS Will Be Sent

FEDERAL AGENCIES

Bureau of Land Management (57 copies)
El Centro Resource Area
1661 South Fourth Street
El Centro, CA 92243

Bureau of Land Management (3 copies)
California Desert District
6221 Box Springs Blvd
Riverside, CA 92507

Bureau of Land Management (3 copies)
California State Office (930.1)
2800 Cottage Way, Rm E2845
Sacramento, CA 95825

Office of Environmental Policy and Compliance (5 copies)
Department of the Interior
MIB Room 2340
1849 C Street
Washington, D.C. 20240

Bureau of Indian Affairs
Fort Yuma Agency
San Pasqual School Road &
Picacho Road
Winterhaven, CA 92283

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Bureau of Mines
MS-5050, Rm. 819
Department of the Interior
Washington, D.C. 20240

Western Field Oper. Center
Bureau of Mines, MS-5100
E. 363rd Avenue
Spokane, WA 99202

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Denver Federal Center (D-150)
Building 67
P.O. Box 2507
Denver, CO 80225

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Fish and Wildlife Service
Department of the Interior
Washington, D.C. 20240

U.S. Fish and Wildlife Service
Carlsbad Field Office
2730 Loker Ave. West
Carlsbad, CA 92008

Offshore Environmental Assessment Division (3 copies)
Minerals Management Service
Department of the Interior
Washington, D.C. 20240

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National Park Service
Department of the Interior
Washington, D.C. 20240

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National Center (423)
Department of the Interior
Reston, VA 22092

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EPA, Room 2119 Mall
Attn: EIS Filing Section, MS A-104
401 M Street, S.W.
Washington, D.C. 20460

Office of Federal Activities
Region 9, EPA
75 Hawthorne Street
San Francisco, CA 94105

Office of Deputy A/S of the USAF
Environment, Safety, Occupational Health
SAF/RQ Room 4C916, Pentagon
Washington, D.C. 20330

HQ-USAF/LEEV (2 copies)
Environmental Division
Bolling AFB, Bldg. 516
Washington, D.C. 20330

Planning Division (2 copies)
South Pacific Division
Army Corps of Engineers
630 Sansome Street, Rm. 1216
San Francisco, CA 94111

Office of Environmental Compliance (EH-23) (2 copies)
1000 Independence Ave. SW
Department of Energy
Washington, D.C. 20585

STATE AND LOCAL AGENCIES

State Clearinghouse (10 copies)
1400 Tenth Street
Sacramento, CA 95814

Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814

Gordon Vanvleck
CA State Resource Agency
1400 Ninth Street
Sacramento, CA 95814

Secretary, California EPA
555 Capitol Mall #235
Sacramento, CA 95814

CA Dept. of Conservation
Environmental Program Coordinator
801 K Street MS-2401
Sacramento, CA 95814

CA Dept. of Conservation
State Mining and Geology Board
1416 Ninth Street, Room 1326-A
Sacramento, CA 95814

CA Office of Historic Preservation
Dept. of Parks and Recreation
P. O. Box 942896
Sacramento, CA 94296

Carrie Shaw
CA Dept. of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

Fred Worthley
CA Dept. of Fish and Game, Region 5
330 Golden Shore #50
Long Beach, CA 90802

Phil Gruenberg
CA Regional Water Quality Control
Board - Region 7
2010 Iowa Ave, #100
Palm Desert, CA 92260

Native American Heritage Commission
915 Capitol Mall, Room 288
Sacramento, CA 95814

John F. Kennedy
Arizona Game & Fish
9140 East County 10½ Street
Yuma, AZ 85365

Executive Director
Southern CA Assoc. of Gvmts. (SCAG)
600 S. Commonwealth Ave., Suite 1000
Los Angeles, CA 90005

Board of Supervisors
County of Imperial
940 West Main, #212
El Centro, CA 92243

Executive Officer
Imperial Valley Assoc. of Gvmts.
940 Main Street
El Centro, CA 92243

Jurg Heuberger
Imperial County Planning Dept.
939 West Main Street
El Centro, CA 92243

Air Quality Control Officer
Air Pollution Control District
150 South Ninth Street
El Centro, CA 92243

S. Harry Orfanos
Public Works Dept.
155 South 11th Street
El Centro, CA 92243

Tom Wolf
Environmental Health Services
939 Main Street
El Centro, CA 92243

Gerald Quick
Imperial County Health Services
939 West Main Street
El Centro, CA 92243

Randy Rister
Imperial County Parks & Recreation
1002 State Street
El Centro, CA 92243

Imperial County Fish and Game
Commission
155 South 11th, Suite C
El Centro, CA 92243

Yuma Co. Chamber of Commerce
P. O. Box 230
Yuma, AZ 85364

ELECTED OFFICIALS

Hon. Barbara Boxer
Senator
3301 Kerner Blvd., Suite 300
San Rafael, CA 94901

Hon. Dianne Feinstein
Senator
11111 Santa Monica Blvd. #915
Los Angeles, CA 90025

Hon. Duncan Hunter
Member of Congress
1101 Airport Road, Suite G
Imperial, CA 92251

Hon. Dave Kelley
State Senator
73-710 Fred Waring Drive, Suite 108
Palm Desert, CA 92260

Hon. Julie Bornstein
State Assemblyman
72880 Fred Waring Drive
Palm Desert, CA 92260

Sam Sharp
Imperial County Supervisor
District 5
660 Olive Ave.
Holtville, CA 92250

CALIFORNIA DESERT DISTRICT ADVISORY COUNCIL

Robert T. Filler
11561 East Via Canada
Yuma, AZ 85365

Elden Hughes
14045 Honeysuckle Lane
Whittier, CA 90604

Dana F. Bell
5764 Campo Wk
Long Beach, CA 90803

Steven Hartman
4444 Longridge Ave.
Sherman Oaks, CA 91423

Mary Ann Fisher
11322 Camarillo Street 103
North Hollywood, CA 91602

Sharon Apfelbaum
523 Camino Del Sur
Palm Springs, CA 92262

James R. Bagley
P. O. Box 219
Twentynine Palms, CA 92277

William M. Claypool III
212 H Street
Needles, CA 92363

Susan Hickman
P. O. Box 36
Yermo, CA 92398

Fred Owins
1820 S. Central Ave., Suite C
Visalia, CA 93277

William Manning
P. O. Box 513
Big Pine, CA 93513

Dr. Kenneth S. Norris
1987 Smith Grade Road
Santa Cruz, CA 95060

LIBRARIES

BLM Library SC-322A
Bldg. 50, Denver Federal Center
P. O. Box 25047
Denver, CO 80225

Palo Verde District Library
125 W. Chanslor Way
Blythe, CA 92225

Brawley Public Library
400 Main Street
Brawley, CA 92227

Calexico City Library
850 Encinas Ave.
Calexico, CA 92231

SDSU Library
720 Heber Ave.
Calexico, CA 92231

Meyer Memorial Library
225 West Main Street
Calipatria, CA 92233

Imperial County Library
1647 West Main Street
El Centro, CA 92243

El Centro Public Library
539 State Street
El Centro, CA 92243

Imperial County Free Library
939 West Main Street
El Centro, CA 92243

Imperial Valley College Library
380 East Aten Road
Imperial, CA 92251

Imperial Public Library
P. O. Box 38
Imperial, CA 92251

Holtville Library
101 East Sixth Street
Holtville, CA 92250

Arizona Western College Library
P. O. Box 929
Yuma, AZ 85366

Yuma County Library District
350 S. 3 Ave.
Yuma, AZ 85364

INDIVIDUALS AND ORGANIZATIONS

Howard & Harriet Allen
Desert protective Council
3750 El Canto Drive
Spring Valley, CA 91977

Carol Brooks
Arizona Historical Society
240 Madison Ave.
Yuma, AZ 85364

Phillip Brymir
2250 East 27th Way
Yuma, AZ 85365

Peter F. Bull
Macquarie Metals, Inc.
1775 Sherman Street, Suite 2900
Denver, CO 80203

California Native Plant Society
El Cajon Chapter
2310 Calle Poco
El Cajon, CA 92021

Coachella Valley Audubon Society
73430 Indian Creek Way
Palm Desert, CA 92260

Colorado River Indian Tribes
Daniel Eddy Jr., Chairman
Route 1 Box 23-B
Parker, AZ 85344

Pat Davison
People for the West
P. O. Box 1856
Running Springs, CA 92382

Phil DeDycker
P. M. DeDycker & Associates
12596 W. Bayaud Ave.
Lakewood, CO 80228

Desert Tortoise Council
P. O. Box 1738
Palm Desert, CA 92261

Desert Tortoise Preserve Committee
P. O. Box 453
Ridgecrest, CA 93555

Environmental Defense Fund
1616 P Street NW
Washington, D.C. 20036

Helen Gilmore
P. O. Box 1481
Yuma, AZ 85366

Jim & Edith Harmon
P. O. Box 444
Ocotillo, CA 92259

Hercla Mining
Attn: Ralph Noyes
6500 Mineral Drive
Coeurd' Alene, ID 83814

Martin Karpiscak
University of Arizona
Office of Arid Land Studies
854 N. Park
Tuscon, AZ 85719

Andy Kaczmarek
Sante Fe Pacific Gold Corp.
Mesquite Mine
6502 E Hwy 78
Brawley, CA 92227

W. Douglas Kari
Orrich Herrington & Sutcliffe
777 S Figueroa Street, #3200
Los Angeles, CA 90017

June Latting
320 Maravilla Drive
Riverside, CA 92507

Leon Lesicka
Desert Wildlife Unlimited
4780 Hwy 111
Brawley, CA 92227

Lining Desert Reserve
47-900 Portola Ave.
Palm Desert, CA 92260

Patrick McCune
Yuma Daily Sun
2055 Arizona Ave.
Yuma, AZ 85364

M-K Gold Company (3 copies)
Attn: Dan Kunz
P. O. Box 73
Boise, ID 83729

M-K Gold Company
Attn: Mark Blakely
Castle Mountain Mine
P. O. Box 90460
Henderson, NV 89009

Kevin McArthur
Chemgold, Inc.
P. O. Box 758
Winterhaven, CA 92283

National Audubon Society
Western Region
555 Audubon Place
Sacramento, CA 95825

Gregory Ouellette
Western Mining Council
2051 Pacific Ave.
Norco, CA 91760

Quechan Tribal Council
Tribal Chair
1890 San Pasqual School Road
Winterhaven, CA 92283

Deborah Reames
Sierra Club Legal Defense Fund
180 Montgomery Street, #1400
San Francisco, CA 94104

Patricia Rice
I V Press
P. O. Box 791
Brawley, CA 92227

Terry V. Rogers
American Girl Mining Joint Venture
P. O. Box 879
Winterhaven, CA 92283

Glen Rouse
California Mining Association
1121 L Street, #909
Sacramento, CA 95814

Robert Schiller
High Desert Multi-Use Coalition
1163 S Garth
Ridgecrest, CA 93555

Debbie Sease
Sierra Club
408 C Street NE
Washington, D.C. 20002

Sierra Club - San Diego Chapter
Cahuilla Desert Group
756 Tangerine Street
El Centro, CA 92243

Sierra Club - San Diego Chapter
3820 Ray Street
San Diego, CA 92104

Richard Spotts
Defenders of Wildlife
5604 Rosedale Ave.
Sacramento, CA 95822

Mike Stanwood
P.M. DeDycker & Assoc.
864 Milwaukee Street
Denver, CO 80209

Rosela Stout
Gold Rock Ranch
P. O. Box 697
Winterhaven, CA 92283

Michael Tornabene
1525 SW Troon Circle
Palm City, FLA 34990

Walt Tunnessen
Sierra Club
3820 Ray Street
San Diego, CA 92104

Johanna H. Wald
Natural Resources Defense Council
71 Stevenson Street, #1825
San Francisco, CA 94105

Bill Werner
2800 South 1st Ave., Apt. C
Yuma, AZ 85364

Wilderness Society
900 Seventeenth Street NW
Washington, D.C. 20006

Wilderness Society
116 New Montgomery, #526
San Francisco, CA 94105

Wildlife Society
5410 Grosvenor Lane
Bethesda, MD 20814

Monta W. Zengerle
Morrison-Knudsen Company
126 Wanpan Way
Sequin, TX 78155

CHAPTER 9

REFERENCES

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CHAPTER 10

GLOSSARY

ACEC. Area of Critical Environmental Concern.

ACHP. Advisory Council on Historic Preservation.

ACID DRAINAGE OR ACID ROCK DRAINAGE (ARD). Drainage with a pH of 2.0 to 4.5. It results from the oxidation of sulfides, which produces sulfuric acid and sulfate salts. The acid dissolves minerals in the rocks, further degrading the quality of the drainage water.

ADIT. A horizontal or nearly horizontal passage from the surface into a mine.

AEL. Acceptable Exposure Level.

AESTHETICS. The appeal or beauty of objects, animals, plants, scenes, natural or improved areas to the viewer and his/her appreciation for such items.

AGMJV. American Girl Mining Joint Venture.

ALTERNATIVE. One of several policies, plans or projects proposed for decision making.

AMBIENT AIR QUALITY STANDARD. A legal limit on the amount of a given pollutant that is permitted in the ambient air.

AMERICAN INDIAN RELIGIOUS FREEDOM ACT OF 1978. An Act which establishes a U.S. Policy to protect and preserve the religious freedom of American Indians by, among other things, allowing access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites. It also requires the President to direct Federal agencies to evaluate their policies in consultation with native religious leaders in order to determine appropriate changes.

ANP/AGP. Acid Neutralization Potential/Acid Generation Potential.

APCD. Air Pollution Control District.

APE. Area of Potential Effect.

AQRV. Air Quality Related Values.

AQUIFER. A geological formation or structure that contains water in sufficient quantity to supply needs for water development.

ARB. Air Resources Board.

ARD. Acid Rock Drainage.

AREA OF INFLUENCE. The geographic area whose social, economic and/or environmental condition is significantly affected by changes in forest resource production or management.

ARPA. Archaeological Resources Protection Act.

ATTAINMENT AREA. An area which meets ambient air quality standards.

BA. Biological Assessment.

BACKFILL. 1) Waste rock, sand or tailings used to support the mine opening after removal of ore from a stope. 2) The process of re-filling a mined-out pit with waste rock.

BAGHOUSE. An air pollution abatement device used to trap particulates by filtering gas streams through large fabric bags, usually made of glass fibers.

BASELINE CONDITION. That condition of the habitat existing prior to disturbance.

BASELINE DATA. That data collected in an area prior to disturbance.

BENCH. A long, narrow, relatively level terrace or platform breaking the continuity of a slope. Also, pertaining to mining, the surface of an excavated area at some point between the material being mined and the original surface of the ground on which equipment can be set, moved or operated.

BIOLOGICAL ASSESSMENT (BA). The information concerning listed and proposed species or critical habitat and proposed critical habitat that the Federal agency must gather and evaluate on any major construction activity. The biological assessment determines which species or critical habitat may be present in the action area and the potential effects of the action on such species or habitat. It also includes an analysis of cumulative effects. The requirements of a biological assessment should be completed in conjunction with the National Environmental Policy Act (NEPA) process.

BIOTA. The flora and fauna of a region.

BLM. Bureau of Land Management.

CEQ. Council on Environmental Quality.

CANDIDATE SPECIES. Classification by the Fish and Wildlife Service (U.S. Department of the Interior) of taxonomic groups or species of plants or animals that are being considered for listing as either threatened or endangered under the Endangered Species Act of 1973, as amended.

CATEGORY 2 SPECIES. See CANDIDATE SPECIES.

CDCA. California Desert Conservation Area.

CDMG. California Division of Mines and Geology.

COMPLIANCE. Compliance with clean air or water standards. Also, compliance with a schedule or plan ordered or approved by a court of competent jurisdiction, the Environmental Protection Agency, or an air or water pollution control agency, in accordance with the requirements of the Air or Water Act and regulations issued pursuant thereto.

CONCENTRATE. The valuable fraction of an ore that is left after worthless material is removed in processing.

CONDUIT. A passage that is filled with water under hydrostatic pressure.

CORRIDOR. A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries.

COUNCIL ON ENVIRONMENTAL QUALITY (CEQ). An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

COVER. The proportion of ground surface under live aerial parts of plants or the combined aerial parts of plants and mulch. Also describes vegetation or terrain used by wildlife for protection from predators and adverse weather conditions, and is a major component of wildlife habitat.

CRITICAL HABITAT. Habitat on which a species depends for survival because there are no alternative ranges or habitats available.

CSC. California Species of Special Concern.

CULTURAL RESOURCE. The remains of sites, structures or objects used by humans in the historic or prehistoric past.

CULVERT. A conduit, especially a drain, under a road, through an embankment, etc.

CUMULATIVE EFFECTS OR IMPACTS. The impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such actions. Cumulative impacts can result form individually minor but collectively significant actions taking place over a period of time.

CUP. Conditional Use Permit.

DATA RECOVERY PROGRAM. The systematic mapping and removal (or reburial) of cultural artifacts at a site.

DEVELOPMENT ROCK. Rock removed in the process of reaching the ore to be mined that is discarded without being crushed and milled.

DISPERSED RECREATION. A general term referring to recreation use outside developed recreation sites; this includes activities such as scenic driving, hiking, backpacking, hunting, fishing, snowmobiling, horseback riding, cross-country skiing, and recreation in primitive environments.

DIVERSITY. The variety of species within a given association of organisms. Areas of high diversity are characterized by a great variety of species; usually relatively few individuals represent any one species. Areas with low diversity are characterized by a few species; often relatively large numbers of individuals represent each species.

ECOSYSTEM. An interacting system of organisms considered together with their environment (e.g., marsh, watershed, and lake ecosystems).

EFFECTS. See IMPACTS.

EIS. Environmental Impact Statement.

EMISSION. A substance released into the air.

ENDANGERED SPECIES. Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range; plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.

ENP. Emergeny Notification Plan.

ENVIRONMENTAL IMPACT STATEMENT (EIS). A statement of the environmental effects of a proposed action and alternatives to it. It is required for major federal actions under Section 102 of the National Environmental Policy Act (NEPA), and released to the public and other agencies for comment and review. It is a formal document that must follow the requirements of NEPA, the Council on Environmental Quality (CEQ) guidelines, and directives of the agency responsible for the project proposal.

ESA. Endangered Species Act.

ETHNOGRAPHY. The branch of anthropology that deals descriptively with specific cultures, especially those of nonliterate peoples.

FAUNA. The animal life of a region.

FCR. Field Contract Representative.

FLMPA. Federal Land Management Policy Act.

FLOODPLAIN. Nearly level land situated on either or both sides of a channel that is subject to overflow flooding.

FLORA. The sum total of the kinds of plants in an area at one time.

FLOTATION. Method of mineral separation whereby a froth created in water by a variety of reagents floats some finely crushed minerals whereas others sink.

FONSI. Finding of No Significant Impact.

FORMATION. A body of rock strata that consists dominantly of a certain lithologic type or combination of types. Formations may be combined into groups or subdivided into members.

FUGITIVE DUST. Wind-borne soil particles which are the result of development activities (e.g., construction equipment, etc.). This dust can be very limited locally or quite extensive in distribution.

GEOCHEMISTRY. The study of the distribution and amounts of the chemical elements in minerals, ores, rocks, soils, water and the atmosphere, and their circulation in nature, ont he basis of the properties of their atoms and ions.

GEOTECHNOLOGY. Application of the methods of engineering and science to exploitation of natural resources.

GPM. Gallons per minute.

GRADE. The relative quantity or percentage of metal content in an ore body.

HABITAT. The place where a plant or animal naturally or normally lives or grows.

HAP. Hazardous Air Pollutants.

HARD ROCK. Rock that requires drilling and blasting for its economical removal.

HDP. High-density polyethylene.

HERPETOFAUNA. The reptiles and amphibians of a specified region or time.

HISTORIC SITE. Site associated with the history, tradition, or cultural heritage of national, state or local interest, and of enough significance to merit preservation or restoration.

IDT. Interdisciplinary Team.

IID. Imperial Irrigation District.

IMPACT AREA. That area affected by a development project.

IMPACTS. Environmental changes resulting from a proposed action. Included are direct impacts, which are caused by the action and occur at the same time and place, and indirect impacts, which are caused by the action and are later in time or further removed in distance, but which are still reasonably foreseeable. indirect impacts may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems. Impacts and effects as used in the EIS are synonymous. Impacts include ecological (such as the effects on natural resources and on the components, structures and functioning of affected ecosystems), aesthetic quality, historic, cultural, economic, social, or health effects, whether direct, indirect, or cumulative. Impacts may also include those resulting from actions that may have both beneficial and detrimental effects, even if on the balance the agency believes that the effects will be beneficial.

INFRASTRUCTURE. The foundation underlying a nation's region's or community's economy (e.g., transportation and communications systems, power facilities, schools, hospitals, etc.).

INTERDISCIPLINARY TEAM (IDT). A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad to adequately solve the problem.

ISSUE OF CONCERN. A point, matter or question of public discussion or interest to be addressed or decided through the planning process.

$L_{eq.}$ Hourly average noise level at a location.

$L_{50.}$ Hourly medium noise level at a location.

$L_{90.}$ The noise level that is exceeded 90% of the time at a location; the background noise level.

LANDFORM. An area that is defined by its particular combination of bedrock and soils, erosion processes, and climatic influences.

LAND USE. The primary or primary and secondary use(s) of land, such as cropland, woodland, pastureland, etc.

LEACHING. The removal of the more soluble materials by percolating waters.

LINED POND. A water storage facility with an amended soil layer or other type of material covering the bottom and slopes to prevent leakage of fluids.

LITHIC. Made of stone.

LITHIC SCATTER. A site characterized by a number of flakes and/or tools but having an ambiguous function.

LOAMY. Soils which are intermediate in texture and properties between fine-textured and coarse-textured soils.

LTVA. Long-term Visitor Area.

METEOROLOGICAL. Of, or pertaining to, the weather or climate.

MILL. The processing plant for mined ore.

MINE DEVELOPMENT. The operations involved in preparing a mine for ore extraction, including tunneling, sinking, crosscutting, drifting, and raising.

MINE PORTAL. The main entrance to a mine.

MINE WATER. Groundwater collected in a mine and drainage from the associated tailings.

MINERALIZATION. The process by which valuable mineral or minerals are introduced into a rock, resulting in a potential or actual ore deposit.

MITIGATION. Mitigation includes: (a) avoiding the impact altogether by not taking a certain action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and (e) for the impact by replacing or providing substitute resources or environments.

MITIGATION MEASURES. Actions to avoid, minimize, reduce, eliminate, or rectify adverse impacts of management practices.

MMPA. Mining and Mineral Policy Act.

MODEL. A representative of reality used to describe, analyze, or understand a particular concept. A "model" may be a relatively simple qualitative description of a system or organization, or a highly abstract set of mathematical equations.

MOU. Memorandum of Understanding.

MSHA. Mine Safety and Health Administration.

NAAQS. National Ambient Air Quality Standards.

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA). Public Law 91-190. Establishes environmental policy for the nation. Among other items, NEPA requires federal agencies to consider environmental value in decision-making process.

NATIONAL HISTORIC PRESERVATION ACT OF 1966. An Act which declares a National policy of historic preservation (defined in the Act as "the protection, rehabilitation, restoration and reconstruction of districts, sites, building, structures, and objects significant in American history, architecture, archaeology, or culture"), including the encouragement of preservation on the state and private levels.

NATIONAL REGISTER OF HISTORIC PLACES (NRHP). A listing (maintained by the U.S. National Park Service) of areas which have been designated as being of historical significance. The Register includes places of local and state significance as well as those of value to the Nation.

NEPA. National Environmental Policy Act of 1969.

NO ACTION ALTERNATIVE. Required by the National Environmental Policy Act, this alternative analyzes the effects of continuing management under existing direction in approved management plans.

NOI. Notice of Intent.

NRHP. National Register of Historic Places.

100-YEAR STORM. The most severe storm event likely to occur once every 100 years.

OHV. Off-highway Vehicle.

ORE BODY. A continuous, well-defined mass of material containing enough ore to make extraction economically feasible.

PERMEABILITY. The capacity of a porous rock, sediment, or soil for transmitting a fluid.

PETROGLYPH. A picture that has been etched onto a rock surface.

pH. A measure of the acidity or basicity of a solution.

PICTOGRAPH. A picture that has been painted on a cave wall or exposed boulder.

PLACER MINING. The extraction and concentration of heavy metals or minerals from placer deposits by various methods, generally using running water.

PLAN OF OPERATION (POO). A document required from any person proposing to conduct mineral-related activities which utilize earth-moving equipment and which will cause disturbance to surface resources or involve the cutting of trees.

PLANT COMMUNITY. An assemblage characterized by certain plant species which are inconspicuous or unrepresented in other assemblages, and wherever areas of equivalent environment are encountered, whether continuous or detached, essentially the same plant assemblage reappears.

PM_{10}. A measurement of the amount of suspended particulate matter (i.e., those particles less than 10 microns in diameter) in the atmosphere.

POO. Plan of Operations.

POTABLE WATER. Water suitable for drinking or cooking, from both health and aesthetic considerations.

PREDATOR. Any animal that kills and consumes another animal.

PROCESS WATER. Water that is used in the mill and associated facilities during ore processing.

PSD. Prevention of Significant Deterioration.

PYRITE. A common yellow mineral (FeS_2) which often contains small amounts of other metals. it is an important ore of sulfur, less so of iron, and is sometimes mined for the associated gold and copper. It is the primary source of acid rock drainage.

RAPTOR. A predatory bird, such as an eagle, hawk, falcon, owl or vulture.

RECLAMATION. Returning disturbed lands to the form and productivity that is ecologically balanced and in conformity with

RECORD OF DECISION. A document separate from, but associated with, an Environmental Impact Statement which states the decision, identifies all alternatives, specifying which were environmentally preferable, and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and if not, why not.

RCRA. Resource Conservation & Recovery Act.

REMEDIAL ACTION. Those actions consistent with permanent remedy taken instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate or cause substantial danger to present or future public health or welfare or the environment.

ROOST. A perch on which birds, bats, etc. rest or sleep. Also, the act of resting or sleeping on a perch.

ROW. Right-of-Way.

RUN-OF-MINE. Said of ore in its natural, unprocessed state; pertaining to ore just as it is mined.

RWQCB. Regional Water Quality Control Board.

SANDY. Soils which are more than 35%, by volume, coarser than 2mm, with enough fines to fill interstices larger that 1mm.

SCAT. A feces or dropping, especially of a mammal or carnivorous bird.

SCOPING PROCESS. A part of the National Environmental Policy Act (NEPA) process;early and open ativities used to determine the scope and significance of the issues, and the range of actions, alternatives, and impacts to be considered in an Environmental Impact Statement (EIS).

SCS. Soil Conservation Service.

SEISMIC. Pertaining to an earthquake or earth vibration, including those that are artificially induced.

SENSITIVE SPECIES. Plant or animal species which are susceptible or vulnerable to activity impacts or habitat alterations; a plant or animal species recognized as needing special management to prevent placement on Federal or state lists.

SHPO. State Historic Preservation Office.

SLURRY. A highly fluid mixture of water and finely divided material (e.g., tailings) for movement by pipeline.

SMARA. Surface Mining and Reclamation Act.

SOCIOECONOMIC. Pertaining to, or signifying, the combination or interaction of social and economic factors.

SOIL HORIZON. A layer of soil or soil material approximately parallel to the land surface and differing from adjacent, genetically related layers in physical, chemical, and biological properties or characteristics, such as color, structure, texture, consistence, kinds and numbers of organisms present, degree of acidity or alkalinity, etc.

SOIL MAPPING UNIT. A kind of soil or miscellaneous area or a combination of soils or of soil(s) and miscellaneous area(s) that can be shown at the scale of mapping for the defined purposes and objectives of the survey. Soil mapping units are the basis for the delineations of a soil survey map, and are generally designed to reflect significant differences in use and management.

STANDARDS AND GUIDELINES. Principles specifying conditions or levels of environmental quality to be achieved.

STEL. Short-term Exposure Limit.

SUBSIDENCE. Sinking or downward settling of the earth's surface, not restricted in rate, magnitude, or area involved. Subsidence may be caused by natural geologic processes, such as solution, compaction, or withdrawal of fluid lava from beneath a solid crust; or by man's activity, such as subsurface mining or the pumping of oil or groundwater.

TAILINGS. Those portions of washed or milled ore that are regarded as too poor to be treated further, as distinguished from the concentrates, or material of value.

TAKE. Action which results in the killing of an animal.

THREATENED SPECIES. Those plant or animal species likely to become endangered species throughout all or a significant portion of their range within the foreseeable future.

TOPOGRAPHY. The configuration of a surface including its relief, elevation, and the position of its natural and human-created features.

UNDERGROUND MINE WORKINGS. The entire collection of adits, declines, stoping making up an underground mine.

USFWS. U.S. Fish & Wildlife Service.

VEGETATION TYPE. A plant community with distinguishable characteristics.

VISUAL RESOURCE MANAGEMENT SYSTEM (VRMS). A system of managing visual resources that establishes visual quality objectives and evaluates the capability of various landscapes to accept modification or alteration.

VISUAL RESOURCE. The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

VRM. Visual Resource Management.

WET. Waste Extraction Test.

WILDERNESS AREA. An area designated by congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wildernesses are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or a primitive and unconfined type of recreation; are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest.

INDEX

APPENDIX A

LAND OWNERSHIP

LODE AND PLACER CLAIMS WITHIN THE ORO CRUZ AND AMERICAN GIRL CANYON OPERATIONAL AREAS

The following unpatented Lode mining claims are situated in the Cargo Muchacho (Hedges, Ogilby) Mining District, Imperial County, California, the names of which and the place of record of the location notices thereof in the official records of Imperial County and the authorized office of the Bureau of Land Management are as follows:

Name of Claim	Owner (see code below)	Imperial County Official Records		BLM Serial # CA MC
		Book	Page	
Hercules 1	A	1601	907	79789
2	B	1601	909	79790
3	B	1601	911	79791
4	B	1601	913	79792
5	B	1601	915	79793
6	B	1601	917	79794
7	B	1601	919	79795
8	B	1601	921	79796
9	B	1601	923	79797
10	B	1601	925	79798
11	B	1601	927	79799
12	B	1601	929	79800
13	B	1601	931	79801
14	B	1601	933	79802
15	B	1601	935	79803
16	B	1601	937	79804
25	B	1601	955	79813
26	B	1601	957	79814
27	B	1601	959	79815
28	B	1601	961	79816
29	B	1601	963	79817
30	B	1601	965	79818
31	B	1601	967	79819
32	B	1601	969	79820
33	B	1601	971	79821
34	B	1601	973	79822
47	B	1601	999	79835
48	B	1601	1001	79836
49	B	1601	1003	79837
50	B	1601	1005	79838
51	B	1601	1007	79839
52	B	1601	1009	79840
53	B	1601	1011	79841
54	B	1601	1013	79842
55	B	1601	1015	79843
56	B	1601	1017	79844

A- Michael G. Tornabene, Edward A. Zraik, Edmund A. Nahas
c/o Michael G. Tornabene, 1523 Southwest Troon Circle, Palm City, Florida 34990.

B- Michael G. Tornabene, 1523 Southwest Troon Circle, Palm City, Florida 34990.

LODE AND PLACER CLAIMS WITHIN THE ORO CRUZ AND AMERICAN GIRL CANYON OPERATIONAL AREAS (cont)

Name of Claim		Owner (see code below)	Imperial County Official Records		BLM Serial # CA MC
			Book	Page	
Hercules	65	B	1601	1035	79853
	66	B	1601	1037	79854
	67	B	1601	1039	79855
	68	B	1601	1041	79856
	69	B	1601	1043	79857
	70	B	1601	1045	79858
	71	B	1601	1047	79859
	72	B	1601	1049	79860
	73	B	1601	1051	79861
	74	B	1601	1053	79862
	87	B	1601	1079	79875
	88	B	1601	1081	79876
	89	B	1601	1083	79877
	90	B	1601	1085	79878
	91	B	1601	1087	79879
	92	B	1601	1089	79880
	93	B	1601	1091	79881
	94	B	1601	1093	79882
	95	B	1601	1095	79883
	96	B	1601	1097	79884
GC	1	B	1464	6	80594
GC	2	B	1464	7	80595
GC	3	B	1464	8	80596
PAT	12	C	1505	1442	94586
	13	C	1505	1443	94587
	14	C	1505	1444	94588
	15	C	1473	413	94589
	16	C	1473	414	94590
	51	C	1471	393	92038
	60	C	1505	1450	92047
	62	C	1505	1451	92049
	64	C	1505	1452	92051
	66	C	1505	1453	92053
	68	C	1505	1454	92055
	101	C	1471	444	92088
	102	C	1471	445	92089
RAY	1	C	1505	1470	84648
	2	C	1466	1703	84649
	3	C	1581	1125-1126	84650
	20	C	1466	1721	84667
	21	C	1466	1722	84668
	22	C	1466	1723	84669
	23	C	1466	1724	84670

B- Michael G. Tornabene, 1523 Southwest Troon Circle, Palm City, Florida 34990.

C- American Girl Mining Joint Venture, P.O. Box 879, Winterhaven, California 92283.

LODE AND PLACER CLAIMS WITHIN THE ORO CRUZ AND AMERICAN GIRL CANYON OPERATIONAL AREAS (cont)

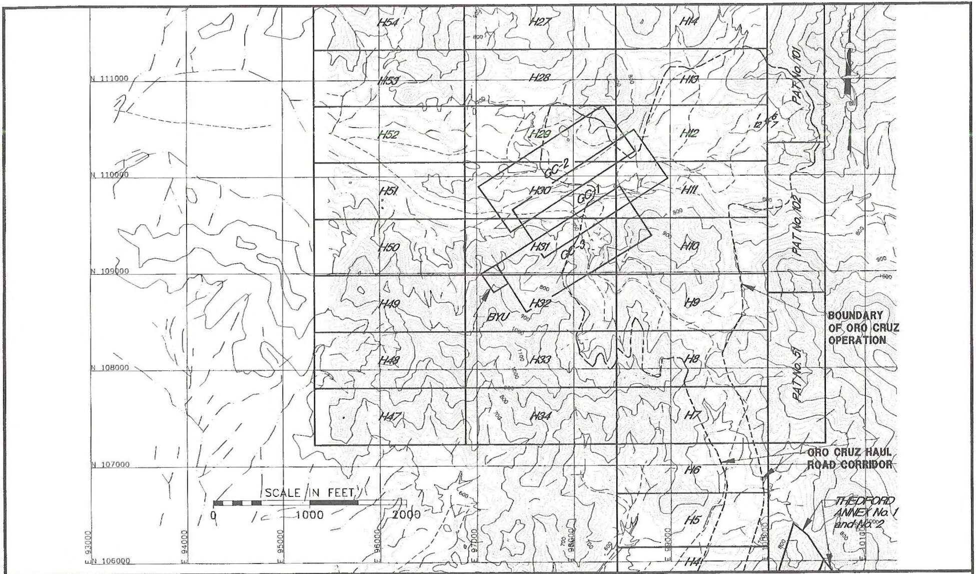
Name of Claim		Owner (see code below)	Imperial County Official Records		BLM Serial # CA MC
			Book	Page	
AGMC	4	C	1581	1113-1114	192302
	5	C	1581	1115-1116	192303
	31	C	1617	1757	220726
PEAK	2	D	1581	1139-1140	34808
	3	D	1581	1141-1142	34802
	7	D	1581	1147-1148	34805
	8	D	1581	1149-1150	34806
	9	D	1581	1151-1152	34807

C- American Girl Mining Joint Venture, P.O. Box 879, Winterhaven, California 92283.
D- Crown Minerals, Inc., P.O. Box 1423, Thermal, California 92274.

PLACER CLAIMS

Name of Claim		Owner (see code below)	Imperial County Official Records		BLM Serial # CA MC
			Book	Page	
Hercules	69	B	1601	833	79912
	70	B	1601	835	79913
	91	B	1601	837	79914
	92	B	1601	839	79915
	187	B	1601	867	204730
	188	B	1601	868	204731
	189	B	1601	869	204732
	192	B	1601	872	204735
	193	B	1601	873	204736
	194	B	1601	874	204737
	195	B	1601	875	204738
	196	B	1601	876	204739
	197	B	1601	877	204740
Tumco Wash	1	B	1601	891	80175
	4	B	1601	894	80178
	6	B	1601	896	80180
	7	B	1601	897	80181
	9	B	1601	899	80183
	10	B	1601	900	80184
	11	B	1601	901	80185
	12	B	1601	902	80186
	13	B	1601	903	80187
	14	B	1601	904	80188
	15	B	1601	905	80189
	16	B	1601	906	80190
Red Rover	22	E	1463	1706	80300
	24	E	1463	1708	80302

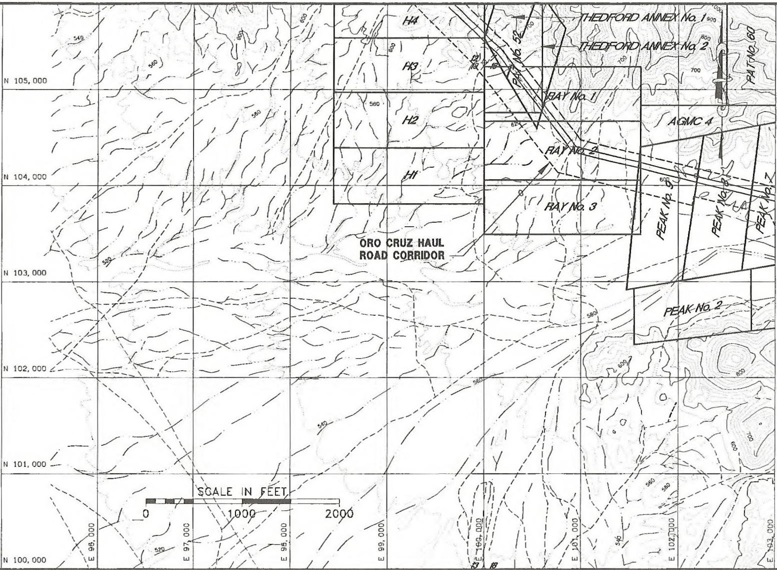
B- Michael G. Tornabene, 1523 Southwest Troon Circle, Palm City, Florida 34990.
E- Estate of P.A. Wolff and M. J. Wolff, Maggie Wolff, J. Moore, J. Smith and L. Smith, W. Agard, C. Slosser, R. Slosser, c/o Mary Joan Wolff, P.O. Box 27, Winterhaven, California 92283



H - HERCULES

FIGURE A-1

CLAIM BOUNDARY MAP FOR ORO CRUZ OPERATION



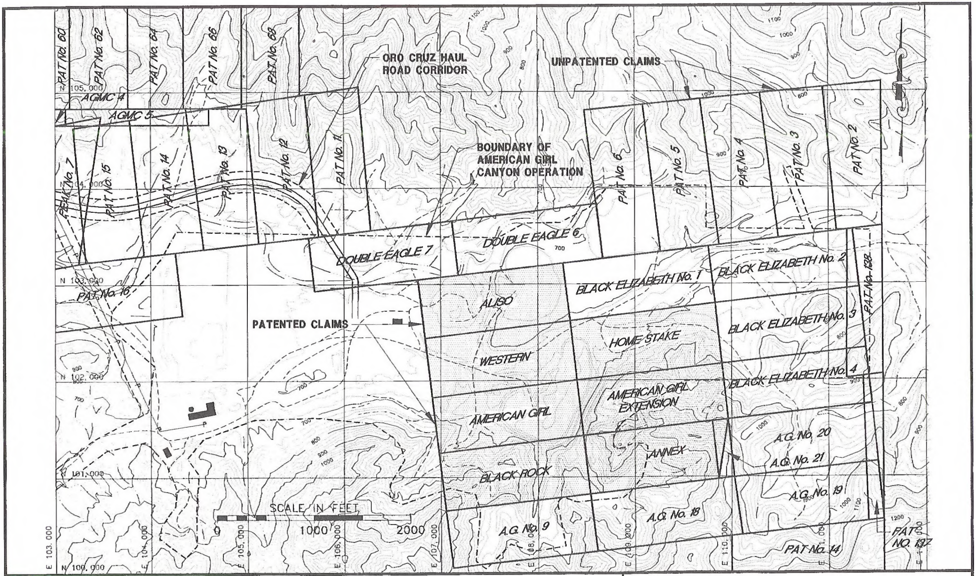
H – HERCULES

KEY

1	
2	3
4	

FIGURE A–2

CLAIM BOUNDARY MAP FOR ORO CRUZ HAUL ROAD



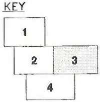
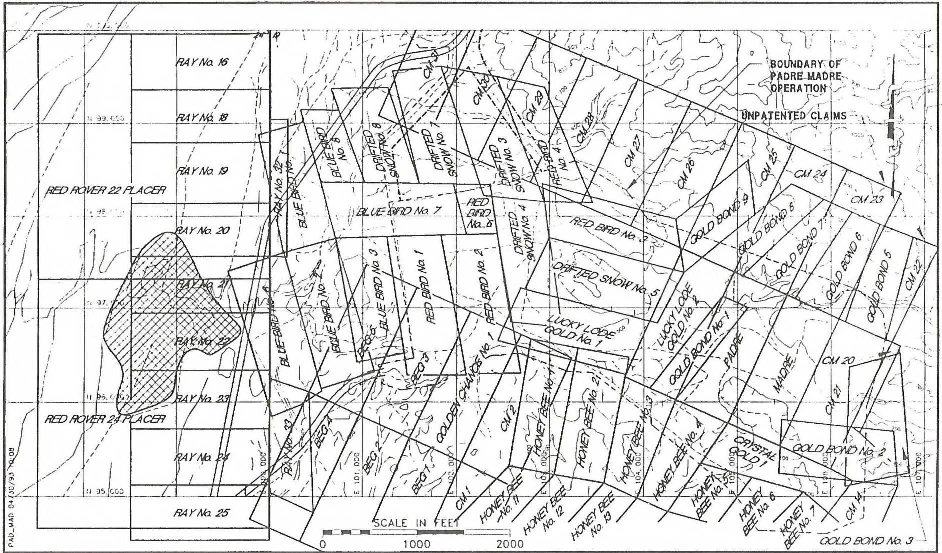


FIGURE A-3

CLAIM BOUNDARY MAP FOR AMERICAN GIRL CANYON EXTENSION AND ORO CRUZ HAUL ROAD



PROPOSED LOCATION OF AGGREGATE SOURCE

PATENTED CLAIMS

KEY

1		
2	3	
4		

FIGURE **A-4**

PADRE MADRE CLAIM BOUNDARY MAP

APPENDIX B

VISUAL CONTRAST RATING WORKSHEETS

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date November 14, 1992

District El Centro

Resource Area Cargo Muchacho Mtns

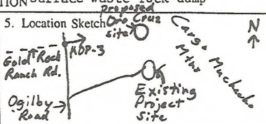
Activity (program) Underground and surface mine/processing facilities surface waste rock dump

SECTION A. PROJECT INFORMATION

1. Project Name
   Oro Cruz Operation
2. Key Observation Point - 1
   Ogilby Road at Gold Rock Ranch Road
3. VRM Class III California Desert Management Plan Class M

4. Location
   Township 15S
   Range 20E
   Section 2

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Foreground-flat, barren. Background-bold, angular, rugged.	Indistinct, short, sparse, amorphous.	
LINE	Foreground-horizontal with transitional edge to background-jagged and undulating	Weak.	
COLOR	Foreground-light greyish tan to light brown. Background-dark brown to garnet.	Pale yellow to green to dark grey.	
TEXTURE	Foreground-smooth, uniform. Background-coarse, irregular.	Random, contrasty, clumped.	

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Solid, horizontal, complex, pyramidal and rectangular, contrasting		
LINE	Horizontal, regular		
COLOR	Light greyish tan, reflective, contrasty-lessened by distance and shadows		
TEXTURE	Smooth, uniform, continuous, ordered, contrasty-lessened by distance		

SECTION D. CONTRAST RATING ☒ SHORT TERM ☒ LONG TERM (MAXIMUM CONTRAST)

1. DEGREE OF CONTRAST

ELEMENTS	LAND/WATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form		X										
Line		X										
Color		X										
Texture		X										

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☒ Yes ☐ No (Explain on reverse side)
New facilities to be painted desert tan

Evaluator's Names	Date
Mike Stanwood	11/14/92

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date November 14, 1992

District El Centro

Resource Area Cargo Muchacho Mtns

Activity (program) Underground and surface mine/processing facilities

SECTION A. PROJECT INFORMATION

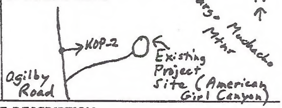
1. Project Name
American Girl Canyon Operation

2. Key Observation Point – 2
Ogilby Road near American Girl Canyon

3. VRM Class III California Desert Management Plan Class M

4. Location
Township 15S
Range 20E
Section 14

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Foreground-flat, barren, expansive. Background-bold, angular, rugged.	Indistinct, short, sparse, amorphous.	
LINE	Foreground-horizontal with transitional edge to background-jagged and undulating	Weak.	
COLOR	Foreground-light greyish tan Background-dark brown to garnet	Pale yellow to green to dark grey.	
TEXTURE	Foreground-smooth, uniform Background-coarse, irregular	Random, contrasty, clumped.	

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Solid, horizontal, complex, pyramidal and rectangular, contrasting		
LINE	Horizontal, complex, regular		
COLOR	Light greyish tan, reflective, contrasty-lessened by distance and shadows		
TEXTURE	Smooth, uniform, continuous, ordered, contrasty-lessened by distance		

SECTION D. CONTRAST RATING ☒ SHORT TERM ☒ LONG TERM (MAXIMUM CONTRAST)

1. DEGREE OF CONTRAST

ELEMENTS	LAND/WATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form		X										
Line		X										
Color			X									
Texture			X									

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☒ Yes ☐ No (Explain on reverse side)
New facilities to be painted desert tan

Evaluator's Names	Date
Mike Stanwood	11/14/92

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date November 14, 1992

District El Centro

Resource Area Cargo Muchacho Mtns

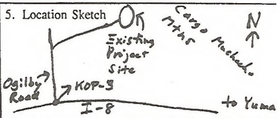
Activity (program) Underground and surface mine/processing facilities

SECTION A. PROJECT INFORMATION

1. Project Name
   American Girl Project
2. Key Observation Point - 3
   Interstate 8 at Ogilby Road
3. VRM Class III — California Desert Management Plan Class M

4. Location
   - Township 16S
   - Range 20E
   - Section 21

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Foreground-flat, linear. Background-prominent, rugged.	Indistinct, spherical, low irregular.	
LINE	Foreground-horizontal straight continuous. Background-complex angular, continuous	Broken, irregular.	
COLOR	Foreground-light tan, reflective. Background-dark brown to garnet	Light brown to pale green and dark green.	
TEXTURE	Foreground-smooth, continuous. Background-coarse, dense	Patchy, coarse, sparse.	

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Horizontal, insignificant.		
LINE	Horizontal.		
COLOR	Light tan/beige, reflective.		
TEXTURE	Smooth.		

SECTION D. CONTRAST RATING ☒ SHORT TERM ☒ LONG TERM (MAXIMUM CONTRAST)

1. DEGREE OF CONTRAST — FEATURES

ELEMENTS	Land/Water Body (1) Strong	Moderate	Weak	None	Vegetation (2) Strong	Moderate	Weak	None	Structures (3) Strong	Moderate	Weak	None
Form			X									
Line			X									
Color			X									
Texture				X								

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names	Date
Mike Stanwood	11/14/92

APPENDIX C

VISUAL EFFECT SIMULATIONS

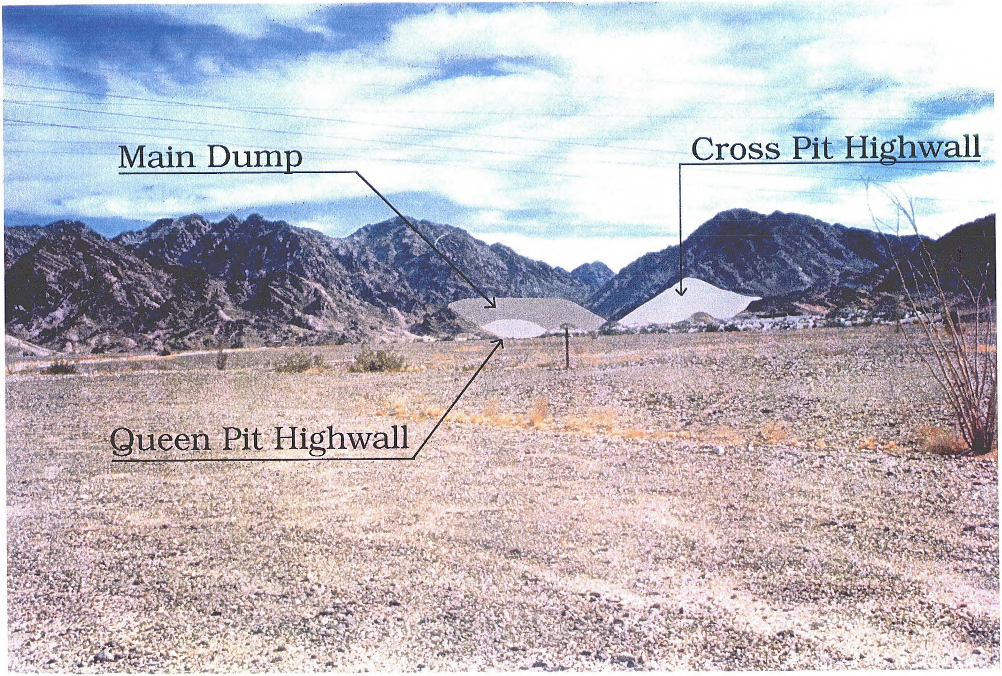


FIGURE C-1
SIMULATED VIEW FROM KOP-1

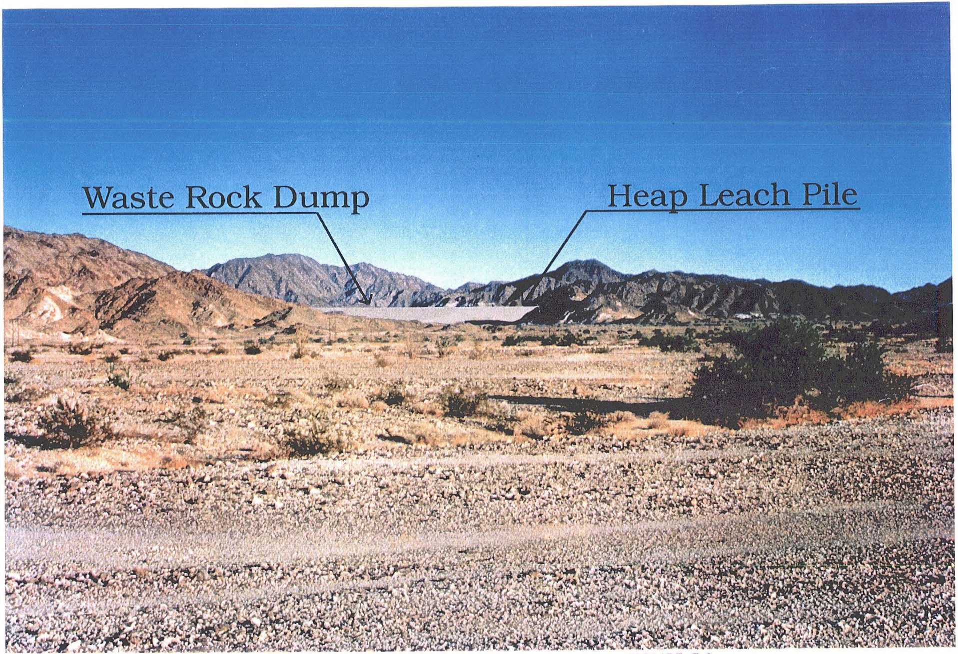


FIGURE C-2
SIMULATED VIEW FROM KOP-2

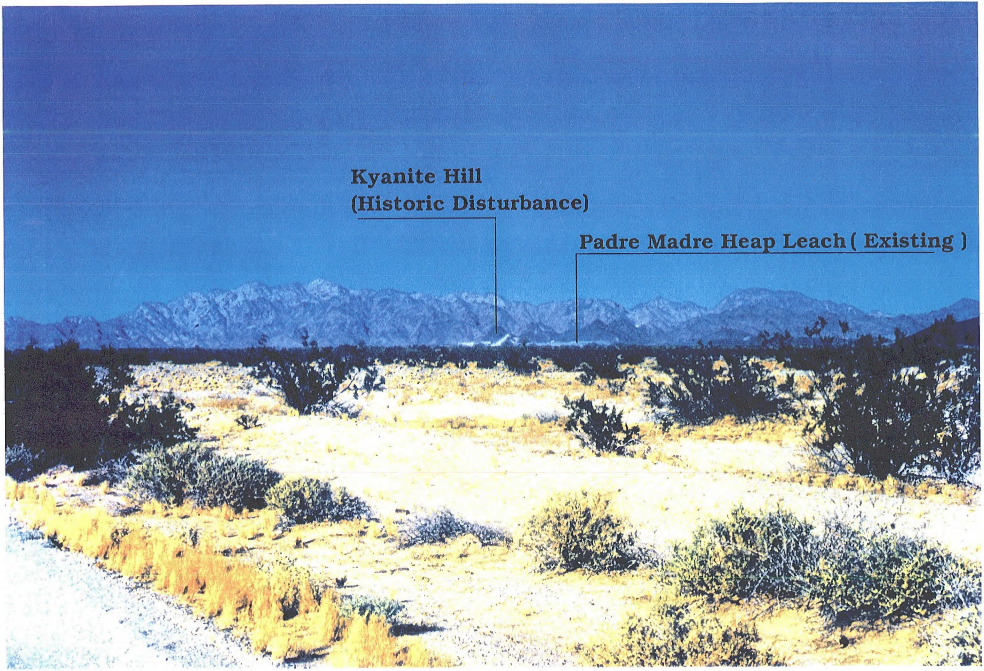


FIGURE C-3
ACTUAL EXISTING VIEW FROM KOP-3